FGI The Facility Guidelines Institute

Guidance for Designing Health and Residential Care Facilities that Respond and Adapt to Emergency Conditions

FGI EMERGENCY CONDITIONS COMMITTEE

March 2021

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The Facility Guidelines Institute (FGI) is a not-for-profit corporation founded in 1998 to provide leadership and continuity to the revision process for the *Guidelines for Design and Construction* documents. FGI functions as the coordinating entity for development of the *Guidelines* series of documents using a multidisciplinary, consensus-based process and for provision of ancillary services that encourage and improve their application and use. FGI invests revenue from sales of the *Guidelines* documents to fund the activities of the next revision cycle as well as research that can inform the *Guidelines* development process.

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This white paper is dedicated to these heroes of the COVID-19 pandemic: the health and residential care workers and support personnel who worked tirelessly to provide quality care to patients and residents under very difficult circumstances, and the design professionals, facility managers, and contractors who devised timely, creative solutions to provide safe work environments.

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Preface

For decades, the Facility Guidelines Institute (FGI) and the Health Guidelines Revision Committee (HGRC) have reviewed, discussed, and considered weather-related and man-made events when developing the *Guidelines for Design and Construction* documents. With each successive edition of the *Guidelines*, the HGRC has made incremental changes addressing systems and building resiliency.

However, the impact of the COVID-19 pandemic on health and residential care facilities and their occupants, coupled with hazards from more frequent and challenging weather-related emergencies, has made plain that more guidance is needed. In March 2020, the FGI Board of Directors instructed the FGI staff to begin developing two new tools to assist facilities during emergency events caused by weather, pandemics, wildfires, and other emergency situations. The first tool—this white paper—was conceived as an advisory document to provide design and operational guidance; the second tool—the pending *Guidelines for Emergency Conditions in Health and Residential Care Facilities*—will be a regulatory document

with fundamental design requirements for facilities at risk from emergency conditions.

To accomplish these lofty goals, FGI assembled the 130-person Emergency Conditions Committee (ECC). Nine subcommittees were formed to explore nine topic areas: safety risk assessment, surge capacity, alternate care sites, modular construction, weather and man-made event resiliency, renovations and future facilities, small and/or rural facilities, residential/adult care settings, and operational considerations. Tasked with developing recommendations and new *Guidelines* requirements based on case studies, best practices, historically effective solutions, and lessons learned, this all-volunteer body of subject matter experts embarked on a 10-month journey to collect, examine, and evaluate design concepts for emergency conditions proposed by professionals in the health and residential care owner and designer community. The work of the ECC was divided into two distinct phases:

- **Short-term**. As initially planned, the ECC would conduct a review of temporary solutions implemented during the early months of the COVID-19 pandemic in an effort to provide guidance on which design interventions are helpful and which are potentially harmful to staff, patients, and residential care residents. Working with government agencies and partner organizations, the committee would assemble and review recommendations for health and residential care organizations planning for emergency events.
- **Long-term**. Following the short-term phase, the ECC would create a new minimum standards document specific to emergency conditions in accordance with FGI's mission to "establish and promote consensus-based guidelines and publications, advised by research, to advance quality health care." FGI follows a time-tested (40-year) standards development process in which the *Guidelines* documents are revised on a four-year cycle by a committee of multidisciplinary experts (including clinicians, architects, engineers, infection preventionists, code enforcement officials, and facility managers), and vetted by the health and residential care communities at-large through public

review. The *Guidelines* documents published at the end of this process are adopted by state and federal agencies and private accrediting organizations. FGI and the ECC have relied on the strength of this process to review, evaluate, and write guidance that will assist health and residential care organizations in preparing for emergency conditions.

Although the ECC was convened in response to the COVID-19 pandemic, the committee embraced the opportunity to address design and operational considerations for emergencies that are local (e.g., floods, train derailments, mass shooter incidents), regional (e.g., tsunamis, earthquakes, hurricanes), and international (e.g., pandemics and other public health emergencies of international concern) in scale. The resulting white paper offers guidance on a wide array of considerations that are applicable to health and residential care facilities across the country.

Each chapter presents considerations and recommendations from one of the nine subcommittees, with two exceptions: The work of the modular subcommittee has been incorporated into the chapter on alternate care sites due to its strength as a potential solution when a facility is forced to surge beyond its footprint, and the operational considerations subcommittee's work has been incorporated throughout the white paper. The subcommittees all operated independently throughout the 10 months. Accordingly, each group's approach to their task was unique. One developed a tool to assist designers and owners, others wrote case studies, and one created a new component for the safety risk assessment, but all groups drafted new text and/or proposed changes for the *Guidelines* documents. These are presented as drafted by the subcommittees at the end of each chapter.

To continue following FGI's standards development process, these recommended guidelines are made available for public review and comment via this white paper. The draft requirements for the *Guidelines for Emergency Conditions in Health and Residential Care Facilities* have been consolidated from the independent recommendations of the nine subcommittees and are presented comprehensively in the final section of this white paper.

Comment on the draft Emergency Conditions Guidelines *by June 30, 2021.*

The 2022 FGI *Guidelines for Emergency Conditions in Health and Residential Care Facilities* will establish new minimum requirements for health and residential care facilities. The intent of this new standard is to provide designers, owners, and authorities having jurisdiction with design requirements and guidance—for new construction and renovation projects—specific to preparedness to meet emergency conditions.

The draft *Guidelines for Emergency Conditions* is included in this white paper, and **the public is invited to submit comments on the draft from April 1 through June 30, 2021**. Experience from the field is critical to develop requirements and recommendations that are neither too restrictive nor permissive.

Access the FGI comment platform at http://emergencyconditions.fgiguidelines.net. Written materials and instructional videos to guide new users through the comment submission process are available on the site.

Gathering input from the health and residential care community is a crucial step in creating the *Guidelines* documents. Accordingly, a three-month public comment period on the draft *Guidelines for Emergency Condition in Health and Residential Care Facilities* will commence with the release of this white paper. During the comment period, the ECC and FGI encourage all interested parties to review and provide feedback on the draft Emergency Conditions *Guidelines* at http://emergencyconditions.fgiguidelines.net.

All of the great work that went into developing this white paper and the draft *Guidelines for Emergency Conditions* would not have been possible without the forward-thinking work of the members of the ECC, government agencies, non-government organizations, and numerous architecture and engineering firms and health and residential care organizations that have been working to generate solutions and provide advice on how best to design, modify, and operate facilities when significant emergency events occur. Thousands of hours have been contributed to this effort by many talented professionals who gave up weekends, evenings, and extensive time away from their places of business—in the midst of a global pandemic—in order to provide critical guidance to health and residential care organizations.

In the midst of a disaster, society should not have to hurriedly develop and create new solutions when time-tested designs, products, and alternate care models have been successfully implemented in similar events in the past. FGI and the ECC hope the *Guidance for Designing Health and Residential Care Facilities that*

Respond and Adapt to Emergency Conditions will become a valued resource for health and residential care organizations seeking to improve facility preparedness and resiliency and a helpful advisory tool for facilities that are forced to create or convert space to deliver necessary care when disasters occur.

On behalf of the FGI Board and staff, we express our boundless gratitude to the members of the Emergency Conditions Committee and other volunteers who generously gave of their time and knowledge to develop this guidance document and the associated *Guidelines for Emergency Conditions*.

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During the ten months while the Emergency Conditions Committee (ECC) was drafting the content of this white paper, many in the health care field were experiencing the effects of a global pandemic firsthand. In addition to supporting the facilities and communities in which they serve, the extraordinary individuals listed below worked tirelessly to gather, discuss, review, and compile the information included in this publication, many doing so while balancing a "new normal" of working from home and caring for family. These individuals recognized a critical need for guidance on planning for and responding to emergency conditions and they generously volunteered to share their expertise, wisdom, and time.

FGI recognizes both the prodigious collective knowledge of this committee and the sacrifices made to bring this white paper to fruition. To all who served on the 2020 Emergency Conditions Committee, we extend our deepest gratitude.

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Note: ECC members who served on more than one of the groups listed have a shortened listing after their first appearance.

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Glossary

Specific terms and definitions are provided to facilitate consistency in this white paper. Some of these terms may have a broader definition in other contexts; the definitions provided here reflect use of the terms as they appear in this publication. For words that do not appear here, please refer to the Merriam-Webster Collegiate Dictionary.

Disaster, emergency, and vulnerability assessment (DEVA): A component in the existing framework of the safety risk assessment (SRA) intended to leverage the information developed from mandated organizational hazard vulnerability analyses (HVAs).

Disrupter: A material or operational challenge and/or condition that, when left unaddressed, may negatively affect the delivery of patient care during an emergency event.

Emergency condition: An event that rises to the level of a disaster and disrupts the normal processes of providing patient or resident care.

Hazard: A circumstance, process, or human activity that can lead to harm, damage, or loss. In the category of emergency preparedness, a hazard can include naturally occurring events such as epidemics, earthquakes, hurricanes, and tornadoes as well as man-made events such as terrorism, chemical spills, and explosions.

Hazard vulnerability assessment (HVA): A process for identifying and documenting potential emergency events that may affect a facility's ability to provide patient care services, considering both the likelihood and consequences of specific events. The Centers for Medicare & Medicaid Services (CMS) requires hospitals to conduct an HVA and update it annually.

Hardening: A design strategy to mitigate damage from catastrophic events such as tornadoes, floods, explosions, etc. Examples could include reinforcing walls and providing automatic flood barriers.

Modular construction: A process in which a building is constructed off-site, under controlled plant conditions, using the same materials and designing to the same codes and standards as conventionally built facilities. Buildings are produced in "modules" that, when put together on-site, reflect the identical design and specifications of a site-built facility.

PAR (periodic automatic replenishment) level: A minimum quantity threshold of an item stocked that triggers automatic reordering.

Resiliency: A health or residential care facility's ability to withstand adverse events. Resiliency includes planning and preparation for an event, the ability to absorb a surge in patients or residents during an event, and recovery and adaptation after an event.

Risk: The probability that a specific adverse event or condition will occur in a specific time period or as a result of a specific situation. Risk is evaluated as a combination of likelihood and consequence. In health care, consequences most often consider injury or death, but organizations may also evaluate property damage, loss of critical

infrastructure services, environmental damage, economic distress, or reputational issues.

Safe zones: Planned areas in a facility where patients, staff, and visitors can be quickly relocated during an emergency event. These could include corridors, interior suites, sleeping areas, exam rooms, lounge or dining areas, or other low-hazard areas.

Small and/or rural health care facilities: Small inpatient (35 beds or less) and outpatient facilities located in rural or urban areas. Many of these facilities serve communities with limited medical resources.

Surge: A temporary increase in medical need in a specific area or community that exceeds the planned, intended capacity of a particular health care building, facility, or system.

Surge capacity: The number of patients a facility can accommodate above its planned capacity. A surge of unexpected additional patients can stretch an organization's ability to provide care in routine planned locations in a building. Surge capacity does not include capacity needs based on insufficient space due to poor planning, financing, or predictable seasonal disease patterns (e.g., annual flu surge).

Acronyms

ACH—air changes per hour

ACS—alternate care site

AHCA—American Health Care Association

AHJ—authority having jurisdiction

AII—airborne infection isolation

ANSI—American National Standards Institute

ASHE—American Society for Health Care Engineering

ASHRAE—American Society of Heating, Refrigerating and Air-Conditioning Engineers

CAH—critical access hospital

CBR—chemical, biological, or radiological

CDC—Centers for Disease Control and Prevention

CMS—Centers for Medicare & Medicaid Services

COVID-19—coronavirus disease 2019

CPTED—crime prevention through environmental design

DEVA—disaster, emergency, and vulnerability assessment

ED—emergency department

EES—essential electrical system

EMS—emergency medical services

EOP—emergency operations plan

FEMA—Federal Emergency Management Agency

HAI—health care-associated infection

HEPA—high-efficiency particulate air

HICS—hospital incident command system

HIPAA—Health Insurance Portability and Accountability Act

HMAP—hazard mitigation assessment program

HVA—hazard vulnerability assessment

HVAC—heating, ventilation, and air conditioning

ICC—International Code Council

ICRA—infection control risk assessment

ICU—intensive care unit

IES—Illuminating Engineering Society

IHS—Indian Health Services

IT—information technology

LED—light-emitting diode

MEP—mechanical, electrical, plumbing

MERS—Middle East respiratory syndrome

MERV—minimum efficiency reporting value

NCAL—National Center for Assisted Living

NEC—National Electrical Code

NFPA—National Fire Protection Association

NIOSH—National Institute for Occupational Safety and Health

NOAA—National Oceanic and Atmospheric Administration

OR—operating room

PACU—post-anesthesia care unit

PHRAT—Pennsylvania Public Health Risk Assessment Tool

POD—portable-on-demand

PPE—personal protective equipment

RN—registered nurse

RSRA—resident safety risk assessment

RTLS—real-time location system

RUPRI—Rural Policy Research Institute

SARS—severe acute respiratory syndrome

SRA—safety risk assessment

UPS—uninterruptible power supply

USACE—U.S. Army Corps of Engineers

USDA—U.S. Department of Agriculture

USP—U.S. Pharmacopeial Convention

USP-NF—U.S. Pharmacopeia-National Formulary

UVGI—ultraviolet germicidal irradiation

Chapter 1: Risk Assessments

As part of the Facility Guidelines Institute (FGI) Emergency Conditions initiative, a disaster, emergency, and vulnerability assessment (DEVA) is proposed as a component of the safety risk assessment (SRA), which the FGI *Guidelines* requires as a planning tool for new construction and renovation projects. This addition to the SRA is intended to leverage the information developed from mandated organizational hazard vulnerability assessments, which may not fully consider the built environment implications in responding to an emergency condition.

The DEVA is not meant to define the operational characteristics of an emergency response (e.g., number of beds required). Rather, it is to be considered *alongside* the organization's hazard vulnerability assessment (HVA) and any planned operational responses to ensure the physical environment supports intended goals for care (e.g., size and characteristics of a space or solutions for care). Health care organizations are required by the Centers for Medicare & Medicaid Services and accrediting organizations to conduct HVAs. Design solutions that support safe delivery of care during

emergency conditions should be coordinated with and supplement organizations' existing HVAs. The intent of the DEVA is to proactively identify built environment solutions that can mitigate risk from potential hazards. The DEVA can be used at any time to create or update an organization's HVA.

The proposed framework for the DEVA entails three steps:

1. Identify hazards specific to the project.
2. Evaluate risks from those hazards.
3. Generate potential solutions to address the risks.

This chapter provides an overview of safety, harm, and hazards and describes a proactive approach to safety through design of the health and residential care built environments. The development of the DEVA is discussed in the context of HVAs and the SRA, while hazards, risks, and risk matrices are presented in the context of common matrices, risk models, and other tools. The three-step DEVA process is outlined in the context of the content found in subsequent chapters of this white paper, and a supporting case study illustrates use of the DEVA in a retrospective evaluation of a pandemic condition. Finally, recommended changes to the *Guidelines* are proposed, along with alignment of the DEVA with existing processes and potential challenges to adoption.

Safety, Harm, and Hazards

Safety is a foundational aspect of health care, yet preventable adverse events continue to affect the safety of patients/residents, staff, and others who use modern health care facilities. Harm resulting from any unsafe condition (direct or indirect) is typically a result of the complex interactions of a system that includes the organization (e.g., culture, operational policies and procedures); people; and technology, equipment and—importantly—the built environment. Harm includes adverse events often reported in health care environments: patient falls; medication administration, preparation, and distribution errors; and health care-associated infections (HAIs), among others. Harm is also associated with fire and life safety

hazards as well as the increasing prevalence of extreme weather conditions, man-made events, and the epidemic or pandemic spread of disease. The risk of harm from these hazards emphasizes the importance of designing care environments with safety in mind.

Left unaddressed, hazards can prevent health care providers from providing safe, effective, patient-centered, timely, equitable, and efficient care. These six aims for patient care (safety, efficacy, patient-centeredness, timeliness, equality, and efficiency) were identified as areas for improvement in the 2001 Institute of Medicine report *Crossing the Quality Chasm*, which posits that safety and quality issues were rampant in the health care industry due to a widespread reliance on outmoded systems of work. The report also notes that within this context, "poor designs set the workforce up to fail, regardless of how hard they try."[1] Unfortunately, safety has not improved in the last two decades to the level many had hoped, and preventable harm remains a significant problem in health care.[2]

"Every system is perfectly designed to get the results it gets."

—Paul Batalden, MD

A Proactive Approach to Safety

In the past, FGI has explicitly focused on safety as it pertains to preventable adverse events, but today there is an industry-wide need to consider how design of health care settings can proactively support emergency preparedness and disaster planning. Creating solutions in response to adverse events is suboptimal, at best; proactive approaches are better suited to protecting the safety of patients, residents, and the "essential workers" who care for them. Every project, site, and organization will have its own set of safety solutions relative to the scope, care model, and patients/residents receiving care, and each organization will have its own level of risk tolerance. This is why it is important to recognize that designing for safety is ultimately a proactive process, not a prescriptive set of solutions.[3]

The need for safety permeates many dimensions of health care. Safety is equally important in contexts of nursing quality improvement initiatives, risk management, emergency preparedness, regulatory compliance, capital planning, and facility management.

In all cases, it is evident that the design of the built environment is a crucial part of establishing a quality of care that promotes safety, that is, the prevention or moderation of hazard-induced harm. Stakeholders involved in the design and construction of health care facilities can play an active role in incorporating safety measures into the physical construction of care settings, whether these settings are newly constructed or undergoing renovation.

Development of the DEVA

The DEVA, like the safety risk assessment, is intended to deploy a multidisciplinary team as part of a proactive process for design and construction of new or renovated facilities. However, the process may also be adapted as part of an incident command response for existing facilities for which multiple options need to be evaluated, including a range of permanent, adaptive, and/or temporary solutions. As mentioned at the beginning of this chapter, the DEVA is meant to build on the hazard vulnerability assessment required by the Centers for Medicare & Medicaid Services (CMS) and many accrediting organizations and to expand the use of the SRA.

Hazard Vulnerability Assessments

CMS defines the HVA as a systematic approach to identifying hazards or risks that are most likely to have an impact on a health care facility and the surrounding community.[4] Additionally, CMS defines the HVA as "the process by which a provider or supplier will assess and identify potential gaps in its emergency plan(s). Potential loss scenarios should be identified first during the risk assessment."[5]

CMS also indicates the term "*facility-based* risk assessments" means the emergency preparedness program is specific to a facility, taking into account geographic location, patient/resident/client population, facility type, and potential community assets, which may differ according to location (e.g., rural vs. large metropolitan area).[6] Although this description may be interpreted to have more of an operational focus, there are inherent built environment implications

that should be proactively identified as part of any new construction or renovation project. And it follows that there should be an evaluation of built environment solutions that can be effectively operationalized as well. For example, an unused alternate care site may not be the best use of limited resources if there is no defined process for who will receive care there or enough staff to deliver distributed care.

Although emergency preparedness evaluations may already be taking place in various departments or stakeholder groups in a given health care facility, some stakeholders might not know they are being conducted or how they are being done, causing a potential communication breakdown. To avoid this disconnect and address safety and risk for all care settings, the Emergency Conditions Committee risk assessment subcommittee came up with the concept of a disaster, emergency, and vulnerability assessment to be placed under the umbrella of the SRA in each FGI *Guidelines* document. The goals of this addition to the SRA are to:

1. Remove barriers to communication between stakeholders surrounding safety through the creation of multidisciplinary teams.
2. Adapt the current SRA to take into account the existing regulatory language for HVAs.
3. Reinforce (and streamline to three steps) the previously established process for risk assessment to advance proactive safe design.

Safety Risk Assessment

When the SRA was introduced as a requirement in the 2014 FGI *Guidelines*, its stated purpose was "to help foster a proactive approach to patient and caregiver safety by mitigating risks from the physical environment that could directly or indirectly contribute to harm."[7] As stated in the *Guidelines*:

- All projects shall be designed and constructed to facilitate the safe delivery of care.

- To support this goal, an interdisciplinary team shall develop a safety risk assessment.

Designing a facility to support the safe delivery of care should also include an "all-hazards" approach to risk assessment. CMS defines an all-hazards approach as "an integrated approach to emergency preparedness that focuses on identifying hazards and developing emergency preparedness capacities and capabilities that can address those as well as a wide spectrum of emergencies or disasters."[8]

While the SRA was a new requirement in 2014, the origins of the SRA in the FGI *Guidelines* date back to 2001, when the infection control risk assessment (ICRA) was introduced as a risk-definition and risk-reduction "organizational process" to establish "the potential risk of transmission of various agents in the facility."[9] This was followed in subsequent editions by risk assessments for injury associated with psychiatric patients and with patient handling and movement. In 2010, the concept of a more general patient safety risk assessment was introduced in the appendix to address underlying built environments conditions that might introduce risk.

In 2014, the original nomenclature of a "patient" safety risk assessment was broadened with consensus that safety was not only for patients, but staff, families, visitors, and any others using the facility. Additionally, with mounting concern about the number of assessments being required, language developed for the 2014 *Guidelines for Design and Construction of Hospitals and Outpatient Facilities* included the requirement for an "umbrella" safety risk assessment that encompassed the prior safety issues of infection control, patient handling and movement, and injury associated with mental and behavioral health as well as new components for medication safety, patient falls, patient immobility, and security risk. With a focus on serious reportable events, the SRA was intended to be an interdisciplinary process that would proactively identify hazards and risks and mitigate underlying conditions of the physical environment that contribute to adverse events.

Similarly, the Residential *Guidelines*, introduced as a separate FGI document in 2014, included a resident safety risk assessment

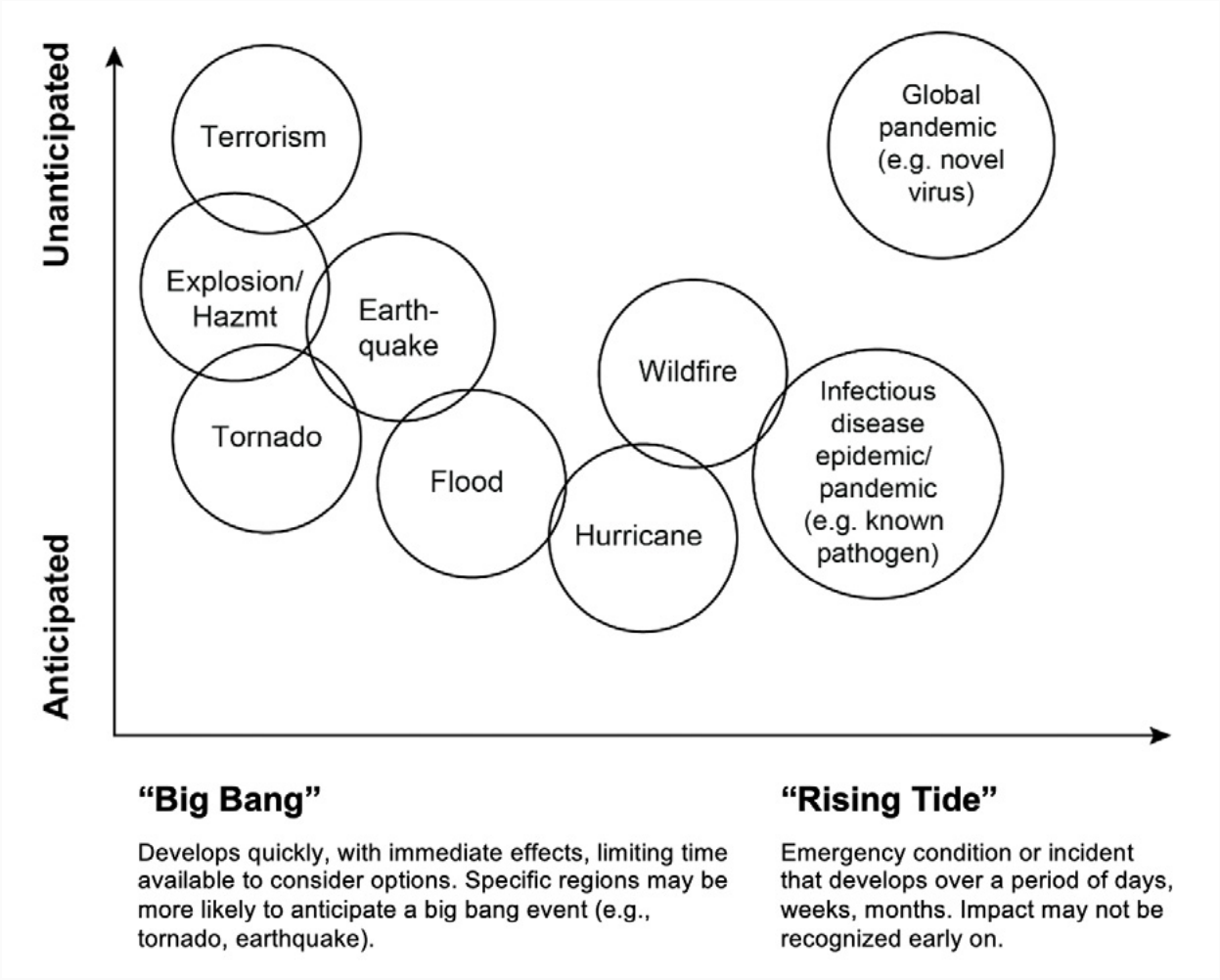
(RSRA) that incorporated similar components: infection control, resident mobility and transfer, resident falls, resident dementia and mental health, security risk, and a specific component for disaster risk and emergency preparedness. The language for the latter component states that "in locations with recognized potential for hurricanes, tornadoes, flooding, earthquakes, or other regional disasters, the need to protect the life safety of all residential health, care, and support facility occupants and the potential need for continuing services following such a disaster shall be considered during project planning and design."[10] The disaster risk and emergency preparedness component of the RSRA was not included in the *Guidelines for Design and Construction of Hospitals and Outpatient Facilities*. However, the security component of the SRA in that document references a broad, "all-hazards" approach.

Risk Models, Matrices, and Other Tools

Identifying hazards and evaluating risks are crucial to designing for safety. While the terms "hazard" and "risk" are often used interchangeably, it is important to distinguish between the two. A hazard is a circumstance, process, or human activity that can lead to harm, damage, or loss. In the category of emergency preparedness, a hazard can include earthquakes, hurricanes, tornadoes, and other "natural" events. Hazards can also include terrorism, chemical spills, explosions, or other "man-made" events. Some hazards may be more anticipated than others, specifically those with a regionally based likelihood (e.g., tornado alley, a hurricane-prone area, a seismic region).

Anticipated hazards may come with some level of advance notice, such as minutes or hours for a tornado watch/warning or days for a potential hurricane landfall. Other hazards, such as an explosion of stored chemicals or a terrorist attack, may be unanticipated. Some unanticipated hazards may evolve into more of an anticipated event (e.g., a global pandemic). Hazards can also be categorized as a "big bang" event or a "rising tide" event.[11] "Big bang" events are single incidents that may be more localized, while "rising tide" events are conditions of prolonged challenge that may also be geographically spread. Figure 1-1 illustrates the intersection of these hazard types.

Figure 1-1: Examples of Hazard Anticipation and Effect



While a hazard is an identifiable "thing," risk is an estimate. Risk is the probability that a specific adverse event or condition will occur in a specific time period or as a result of a specific situation—a combination of likelihood (how often) and consequence (how bad). In health care, consequences most often consider injury or death, but organizations may also evaluate property damage, loss of critical infrastructure services, environmental damage, economic distress, or even reputational issues.

The evaluation of risk can be accomplished in a variety of ways. Some methods incorporate a numeric scoring system that is the product of a likelihood and consequence score, which may then

be categorized as a high, medium, or low risk. Other methods generically identify a risk with nominal terms (e.g., high, medium, low) without a quantifiable calculation. Any method, however, is subjective.

Risk matrices

Risk is often represented visually as a heat map matrix. The matrix may vary by number of cells and color-coding of risk, but a 5x5 matrix with three or four color indicators (Table 1-1) is typical.

Table 1-1: Sample Heat Map to Visually Illustrate Risk

Consequence	Rare	Unlikely	Possible	Likely	Almost Certain
Catastrophic	Yellow	Orange	Red	Red	Red
Major	Yellow	Orange	Orange	Red	Red
Moderate	Green	Yellow	Orange	Orange	Red
Minor	Green	Yellow	Yellow	Orange	Orange
Negligible	Green	Green	Green	Yellow	Yellow

Likelihood

Using the heat map, green zones become a low priority while red zones must have identifiable solutions of some kind. These may be operational rather than built environment solutions. The fuzzy "middle ground" of risk lies in the yellow and orange zones. Each organization will have its own risk tolerance and considerations will vary, especially when taking into account what is both feasible and "reasonably practicable." Because no health care organization has unlimited resources, it is usually unrealistic to design for the highest threat with zero harm.

Risk matrices are sometimes faulted for oversimplification or use in specific quantifiable events (e.g., infectious diseases in blood donors)[12] or when multiple consequences are associated with an event (e.g., injury associated with a fall).[13] However, matrices can be useful when applied to "diverse hazards across a broad organizational portfolio" where the goals are to stimulate a discussion, evaluate what can go wrong, and establish preparedness.[14]

In emergency preparedness and disaster planning, there is the potential for multiple hazards associated with varying risks and multiple areas for disruption in services, hence the need for an "all-hazards" approach. Sample matrices that illustrate this concept are shown in Tables 1-2 and 1-3.[15]

Table 1-2: Sample Hazard Identifications with Likelihood Assessment

Hazard	Category	Likelihood	Notes
Flood	Almost Certain	6	Flooding from ice breakup in the spring occurs annually. Urban flooding during heavy rain also occurs in some areas during the summer.
Earthquake	Rare	1	The facility is in a stable geologic area and has not experienced an earthquake in more than 200 years. Subject matter experts indicate the area is not likely to experience another.

Source: Ontario Provincial Hazard Identification and Risk Assessment Program

Table 1-3: Likelihood of Disruption, Typically Identified in the Hazard Vulnerability Assessment

Rank	Property Damage	Critical Infrastructure	Environmental	Economic
None	Not likely to result in property damage	Not likely to disrupt assets or services	Not likely to result in environmental damage	Not likely to disrupt business/ financial activities
Low	Could cause minor, mostly cosmetic damage	Could cause minor disruption of assets or services	Could cause localized and reversible damage; quick cleanup possible	Disruption of business/financial activities or the economy of the local area
Med	Localized severe damage	Could cause major but localized or short-term disruptions to critical infrastructure services	Could cause major but reversible damage; clean up difficult	Could result in losses for a few businesses, some negative consequences for the economy of the region
High	Widespread severe damage	Could cause widespread severe, ongoing disruption of assets or services	Could cause severe, irreversible damage; cleanup not possible	Could result in losses for an industry or severe economic impact in the region

Source: Ontario Provincial Hazard Identification and Risk Assessment Program

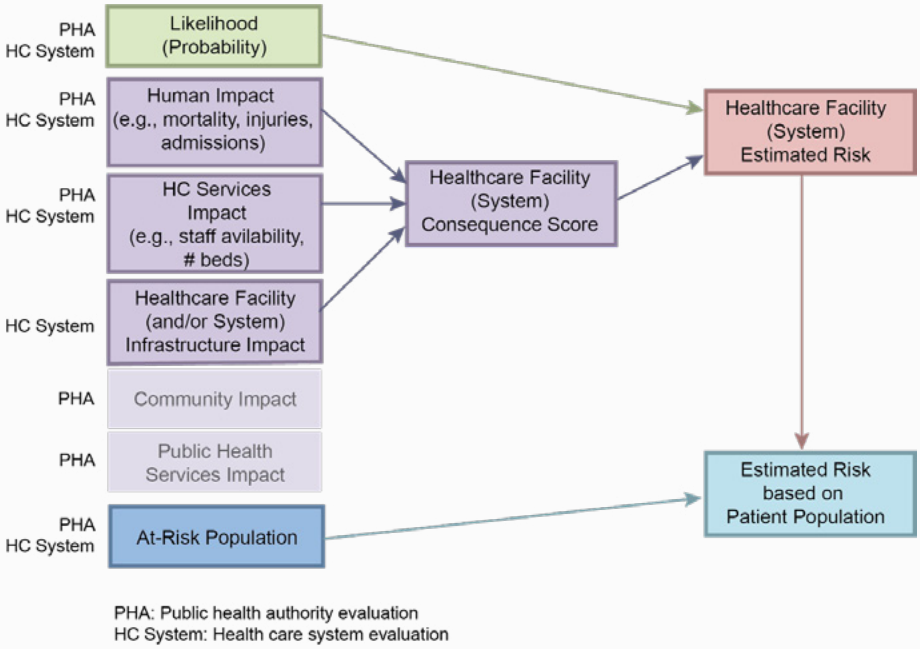
Tools for calculating risk

Where multiple consequences might stem from the same hazard, the team should reach a common understanding of how to establish the final level of risk. For example, the risk of a patient contracting coronavirus disease 2019 (COVID-19) could lead to various degrees of harm: no harm and no hospitalization, non-ICU hospitalization, ICU hospitalization without a ventilator, ICU hospitalization with a ventilator, or death. The likelihood of each of the consequences may also vary. One study found organizations may choose to use the worst-case scenario, the scenario with the highest score (resulting from likelihood × consequence), the most likely scenario, or the reasonably foreseeable worst-case scenario.[16] When considering the built environment, these scenarios should be viewed in the context

of the setting being evaluated and the implications for general strategies and specific strategies for different unit types, as illustrated in the pandemic case study that appears later in this chapter.

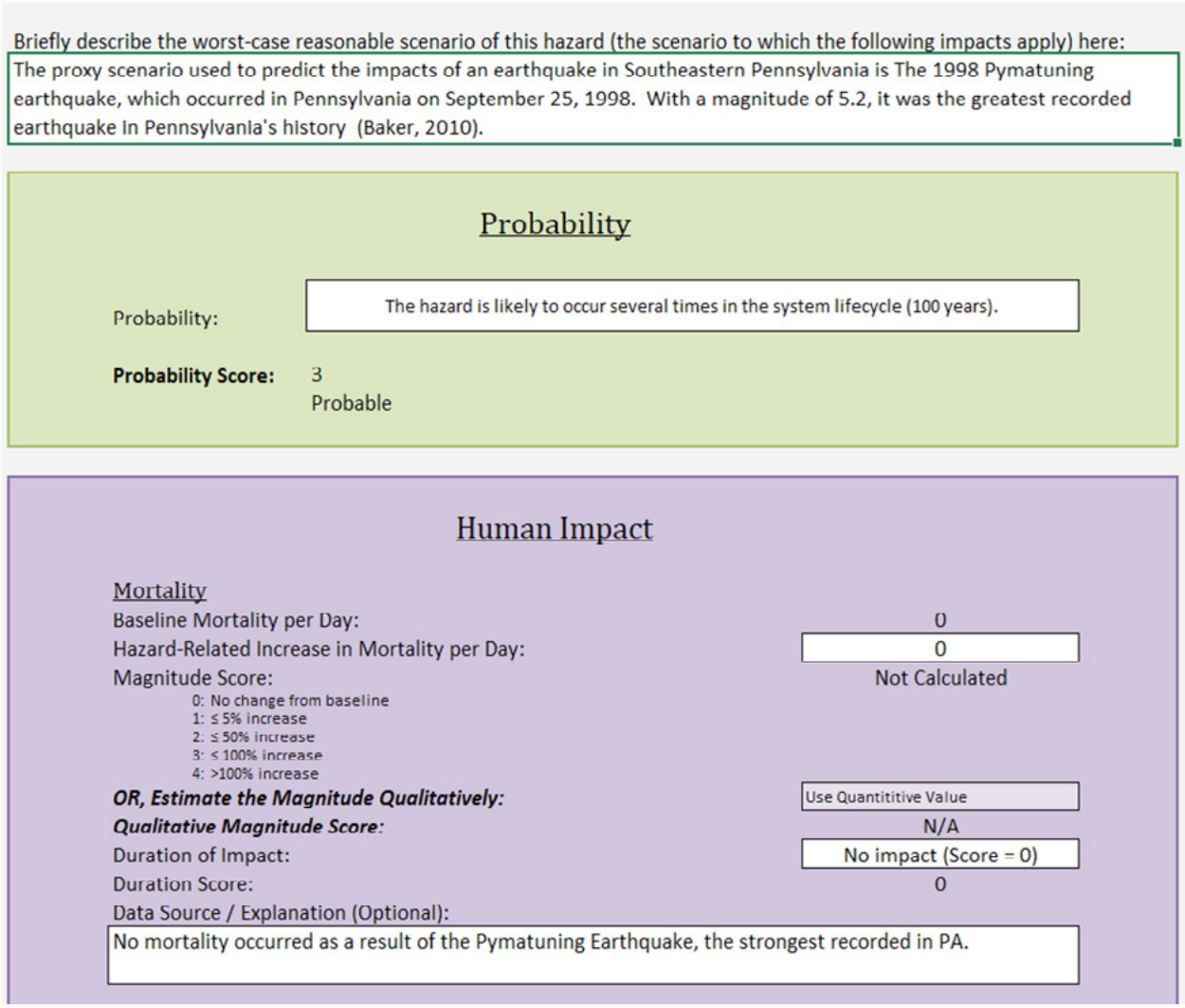
Many tools for creating and maintaining HVAs have been developed by individual organizations, health care systems, and industry associations. During the development of this white paper, various subcommittees reviewed tools from Kaiser Permanente, North Carolina, Georgia, Pennsylvania, Ontario, and the American Society for Health Care Engineering, among others. Numerous publicly available resources also address the types of hazards and vulnerabilities that may be experienced in different geographic areas. For example, the Pennsylvania Public Health Risk Assessment Tool (PHRAT) provides a framework for evaluating risk in the context of consequences from human impact, services impact, and facilities impact (Figure 1-2).[17] This framework is supplemented with an Excel-based tool that provides individual data entry areas for each hazard (Figures 1-3 to 1-5).

Figure 1-2: Pennsylvania Health Care Facility Risk Model



Source: Adapted from the Pennsylvania Public Health Risk Assessment Tool

Figure 1-3: Sample Hazard Data



Source: Screenshot from the Pennsylvania Public Health Risk Assessment Tool

Similar to the Pennsylvania PHRAT, another large health system's tool includes multiple stages of data input with a graphic summary. This Excel-based tool calculates scores associated with multiple hazards (Figures 1-4 and 1-5).[18] This is typical of the HVAs conducted at many organizations throughout the United States.

Figure 1-4: Sample HVA Tab that Calculates Risk Based on Probability, Severity, and Mitigation of Risks

Health System Example *(not actual data)*

Emergency Management

Hazards - Enter name of hospital
Hazard Vulnerability Assessment Tool
Emergent Occurring Events

Event	PROBABILITY	ALERTS	ACTIVATIONS	SEVERITY = (MAGNITUDE - MITGATION)						RISK
				HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	PREPARED-NESS	INTERNAL RESPONSE	EXTERNAL RESPONSE	
	Likelihood this will occur			Possibility of death or injury	Physical losses and damages	Interuption of services	Preplanning	Time, effectiveness, resources	Community staff and supplies	*Relative threat
SCORE	0 = N/A 1 = Low 2 = Moderate 3 = High	Number of Alerts	Number of Activations	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = High 2 = Moderate 3 = Low	0 = N/A 1 = High 2 = Moderate 3 = Low	0 = N/A 1 =High 2 = Moderate 3 = Low	0 - 100%
Active Shooter	2	1	0	3	1	3	2	2	2	36%
Acts of Intent	1	0	0	3	3	3	2	2	2	17%
Bomb Threat	2	0	0	3	3	3	2	2	2	33%
Building Move	2	0	0	1	2	1	2	2	2	22%
Chemical Exposure, External	1	0	0	2	2	1	2	2	2	12%
Civil Unrest	2	0	0	2	2	2	2	2	2	27%
Communication / TelephonyFailure	3	0	0	1	1	2	2	2	2	33%
Dam Failure	0	0	0	2	3	2	3	3	3	0%
Drought	2	0	0	1	1	1	2	2	2	20%
Earthquake	3	10	6	3	3	3	1	1	1	60%
Epidemic	3	0	0	3	1	2	2	2	2	40%
Evacuation	2	12	8	1	1	2	2	2	2	49%
Explosion	2	2	2	2	3	2	2	2	2	48%

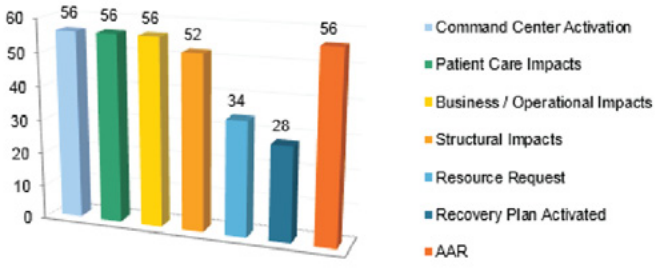
Figure 1-5: Sample Summary Tab–Top 10 Occurrences from Information Gathered in the Data and HVA Tabs

Health System Example *(not actual data)*

Emergency Management

Summary For - Enter Name of Hospital

ALERT TYPE	OCCURRENCE
Command Center Activation	56
Patient Care Impacts	56
Business / Operational Impacts	56
Structural Impacts	52
Resource Request	34
Recovery Plan Activated	28
AAR	56
Total Alert	**82**



2015

TOP 10 HVA	RANK	OCCURRENCE
Flood	1	12
Fire	2	4
Patient Surge	3	13
Power Outage	4	14
Earthquake	5	10
HVAC Failure	6	6
Evacuation	7	12

2015

TOP 10 ACTUAL ALERTS	OCCURRENCE	HVA RANK
Power Outage	14	4
Patient Surge	13	3
Evacuation	12	7
Flood	12	1
Earthquake	10	5
IT System Outage	6	9
HVAC Failure	6	6

While the need to establish the operational model under the HVA is clear, it is equally important to understand how built environment conditions facilitate or become a barrier to patient care. Unfortunately, in many models, the facility impact is limited to critical infrastructure conditions such as water and electrical supply.

The Proposed DEVA Framework

There is no known approach for systematically evaluating multiple built environment decisions that can mitigate risk (e.g., the number of available beds [a services impact] is influenced by unit size, adaptive locations, occupancy, etc.). As a result, the work of this subcommittee draws on some of the resources described above in the context of the current requirements for the SRA, which focus on specific evaluation of built environment interventions as one part of an organization's approach to mitigating risk from adverse events.

The proposed framework for the DEVA incorporates the three-step risk assessment process outlined at the beginning of this chapter:

Step 1: Identify hazards specific to the project (Figure 1-1), for example:

- Transmission of disease (i.e., localized, epidemic, pandemic)
- Catastrophic environmental events (e.g., flooding and sea level rise, wildfires, severe and arctic cold, hurricanes, tornadoes)
- Chemical, biological, or radiological attacks
- Civil disturbance
- Conventional explosives
- Hazardous materials release (e.g., nuclear accident, chemical spill)
- Public utility outages
- Other conditions with potential for disruption

Step 2: Evaluate risk (Table 1-1) as a product of:

- Likelihood (i.e., vulnerability, probability, frequency)
- Consequence (i.e., severity of harm)

Step 3: Generate potential solutions. Subsequent chapters in the white paper offer specific considerations that can mitigate risk:

- ***Surge capacity.*** Addresses considerations for seven areas of the built environment: exterior conditions, building access, specific patient surge spaces (e.g., emergency department, surgery), pharmacy and lab spaces, administrative spaces (e.g., command centers), supply and support spaces, and building systems (e.g., power medical gases).
- ***Alternate care sites.*** Suggests the use of both modular construction and mobile/transportable medical units in lieu of more traditional approaches such as stick-built construction and reopening closed health care facilities.
- ***Resiliency.*** Outlines considerations for facilitating continuity of service during multiple types of hazard events, with recommended elements for before the event (i.e., the proactive DEVA context), during the event (i.e., the response action), and after the event (i.e., cleanup and future planning). These events may occur simultaneously.
- ***Renovation and future facilities.*** Includes recommendations in the context of basic solutions (fundamental requirements), enhanced solutions (elements that exceed basic requirements and likely entail additional cost and space that are offset by the benefits of improved safety, increased capacity, cost avoidance, etc.), and advanced solutions (the most robust solutions potentially best suited for health care organizations with tertiary or quaternary destinations).
- ***Small and/or rural health care.*** Covers disrupters associated with the specific vulnerabilities emergency events cause for small hospitals (35 beds or less) and outpatient facilities located in rural or urban areas primarily serving communities with limited medical resources.

- ***Residential settings.*** Includes recommendations primarily focused on nursing homes, hospice, and assisted living (but not at the exclusion of other independent living settings).

The solutions discussed in these chapters might be evaluated to supplement existing organizational HVA tools, but simple tables could be used to identify hazards and risks and related solutions as shown in Tables 1-4 to 1-6. (Note that these tables are presented as a simple illustrative example, and the compendium of code-driven built environment solutions that apply to buildings of high performance and survivability expectations are beyond the purview of FGI.)

Table 1-4: Facility-Based Hazard and Risk Estimation Example

Hazard	Likelihood	Consequence	Risk *(combined)*	Notes
Hurricane	Almost certain	Moderate/major	High	Our coastal Florida location has consistently been ravaged by upper category hurricanes. Built environment implications include ...

Table 1-5: Facility-Based Solutions Generation Example

Facility design considerations	Hazard being addressed	Priority	Risk	Other notes, specific solutions
Reduce breaches of opening in façade, glass breakage	Hurricane-force winds	High	High	Impact-resistant glass

Table 1-6: Operations-Based Solutions Generation Example

Facility design considerations	Hazard being addressed	Priority	Risk	Other notes, specific solutions
Evacuate coastal facility	Hurricane-force winds	High	High	Because the impact of both flooding and damage/extended duration power loss associated with high winds cannot be mitigated through built environment solutions, patients will be evacuated to an inland facility.

Case Study: One Organization's Response to the COVID-19 Pandemic

This case study highlights how the physical environment of an academic medical center in the mid-Atlantic region of the United States was assessed alongside the organization's mandated hazard vulnerability assessment (HVA) to respond to the COVID-19 pandemic. Discussed using the proposed DEVA framework are the changes the health care organization made in rapid response to the pandemic, considering the question, "Had we known this was coming, would we have done anything different in the design of our facilities?"

The medical center is part of a system of 14 inpatient hospitals and hundreds of outpatient sites. Many hospital and health care facilities were impacted in some way by the global COVID-19 pandemic. This case study was an attempt to focus on a few factors that were key to maintaining a safe environment for patient care, taking into account the need to balance benefit, costs, and risk through both operational and built environment solutions.

While treating more than 13,000 COVID-19 patients, and a cumulative total of 3,800 COVID-19 inpatients in the organization's tertiary care facility, the outcomes during the surge period were remarkable. There was no evidence of COVID-19 spread within hospitals that were simultaneously caring for more than 17,000 inpatients who tested negative for COVID-19 over the same time period.

Deploy the Team

For any component of the required safety risk assessment, a team is convened early in the project programming and design process to engage appropriate stakeholders who can help determine what, if anything, may be needed in the project design to address known risks. In response to the pandemic, an incident command center at the academic medical center was led by the medical safety officer,

infectious disease leadership, and infection prevention leadership. Together, they created clear principles for space utilization and clear clinical pathways for patient treatment. Clinical operations were defined to care for different patient types (e.g., COVID-19 patients, potential COVID-19 awaiting diagnosis, patients who did not have COVID-19) according to acuity level (e.g., ICU-level care, non-critical care), and escalation/de-escalation criteria were developed to indicate when patients would be moved in or out of critical care units. The built environment changes needed to support these defined emergency operations plans were then identified.

In addition, four regional team leads were responsible for facility-related changes, which were reviewed for compliance with the FGI *Guidelines* by one designated, highly knowledgeable individual. If internally approved, where waivers were required from the authorities having jurisdictions (AHJs)—primarily state departments of health—safety and infection prevention risk assessments were performed by the patient safety officer and infection prevention staff before the waiver was approved for submission to the AHJ. (Accreditation was involved in the request for a waiver.)

Identify Hazards

While a DEVA is intended to identify multiple hazard types, this case study focuses on the transmission of disease—by droplet, contact, air, and water. In addition, concerns about the ability to provide care in the event of a surge condition needed to be addressed.

As noted above, all health care institutions are required to produce and maintain an HVA for all locations. Typically, the risk of an epidemic or pandemic is included in the HVA and a risk value is assigned. In the years before the appearance of SARS-CoV-2 (the coronavirus that causes COVID-19), there was much speculation about the possibility of a global pandemic. Scares from the SARS-CoV outbreak in 2003-04 and the H1N1 swine flu scare in 2009-10 had many emergency planning experts predicting it was only a

matter of time until the world saw the next global pandemic. As a result, the organization had plans in place when the COVID-19 pandemic emerged in the community in 2020. Some of these plans needed to be adapted based on what was and was not known about COVID-19 in the early days of the pandemic.

Evaluate Risk

Risk estimation can be outlined in a simple tabular format to estimate likelihood and consequence, along with a combined risk estimate and brief explanatory notes (Table 1-7). Likelihood and consequence can be simplified to a combined single estimation of risk using a heat matrix combination (Table 1-1). While some estimations might be informed by historical data, there are times when the data may be unknown, as was the case with COVID-19. When data are not available, estimates are based on the best knowledge at the time.

Generate Solutions

Solutions (permanent, adaptive, and temporary) are generated based on the hazard being addressed and its associated risks. Solutions may also be evaluated as basic, enhanced, or advanced responses. Absent infinite resources, this may mean that some solutions are considered but not implemented if the organization is willing to accept the risk of not doing so or if the existing environment can effectively support the operational model of care. For example, in this case study, the organization could not/chose not to implement negative pressure in all patient rooms as many organizations were doing. In reviewing outcomes, the alternative approaches the organization pursued did not result in negative outcomes. When making such decisions, cost estimates should be considered (first costs and cost avoidance) and priorities can be assigned. Prioritization provides an informed way to determine which items, if any, need to be reevaluated during budgeting or at phasing decision points.

Table 1-7: COVID-19 Disease Transmission Risk Estimates (Patients and Staff)

Hazard	Likelihood	Consequence	Risk *(combined)*	Notes
Contact	At the time, likely	Moderate/major	Medium-High	During the COVID-19 pandemic, contact transmission was initially seen as a risk but lower than droplet transmission. Generically, solutions associated with surfaces and hand hygiene would be medium risk.
Airborne	At the time, unlikely	Moderate/major	Medium	Transmission was not airborne (in accordance with airborne scientific definition); unless with specific procedures such as intubation. Generically, solutions associated with air would be medium-low risk.
Droplet (a subset of contact)	Almost certain	Moderate/major	High	Droplet transmission was identified as the primary source of transmission; Generically, solutions associated with PPE, would be higher risk based on proximity to droplets.
Waterborne	Rare	Moderate/major	Low	Transmission by water routes not identified; initial reports and studies from fecal transmission and community identification. Generically, water-related solutions unnecessary.
Exponential spread of disease	Possible	Major/ catastrophic	High	Develop a Level 1–Level 4 surge plan based on staffing availability should the pandemic have widespread community impact.

Table 1-8 presents a small sample of built environment solutions extracted from a more exhaustive set of operational scenarios (e.g., planning for levels of staff out sick due to COVID-19), equipment acquisitions (e.g., rental of exterior unit heaters and AC units for tents), and other built environment solutions to address the

Table 1-8: Sample Solutions for the Built Environment Based on Risk

Facility Design Considerations	Hazard Being Addressed?	Priority	Risk	Other Notes, Specific Solutions
Surge capacity (ED)	Exponential spread of disease	High	High	Converted the emergency department conference room to additional treatment stations.
Surge capacity (ICU)	Exponential spread of disease	High	High	As elective surgeries were canceled, the perioperative suite was used for COVID-19 patients with an ICRA tent vestibule in the positive pressure, HEPA-filtered ORs. Air volumes were turned back to decrease pressure across the threshold, and freestanding HEPA filters supplemented OR ventilation for air scrubbing.
Surge capacity (morgue)		Medium	High	Rented morgue containers (refrigerated sea boxes) and racks, temporary power, and plywood ramps were added.
Separation of patient populations (inpatient)	Transmission (all types)	High	High	In accordance with the clear emergency operations plan outlined, non-positive, positive, and PUI (patient under investigation) patients were immediately separated. This was critical to the outcome of no known cross-transmission of disease to patients as a result of being in the hospital. Designated COVID-19 units were identified in areas/floors that would be easy to isolate in accordance with the emergency operations plan. PACU and pre-op bays (which have headwall infrastructure and services in place) were used as additional ICU beds for non-infectious patients, facilitating separation of patient populations.

Table 1-8: Sample Solutions for the Built Environment Based on Risk *(continued)*

Facility Design Considerations	Hazard Being Addressed?	Priority	Risk	Other Notes, Specific Solutions
Surfaces (cleaning)	Contact transmission (cross-contamination between patients/ caregivers)	High	Medium-High	Operationally, all known and potential areas where known and unknown positive individuals may have been located in the facilities were deep cleaned. EVS immediately validated cleaning protocols with the infection prevention department and refreshed education of staff in cleaning techniques. From a future design perspective, surfaces would be considered in the ICRA with respect to how well finishes would hold up to cleaning agents to ensure surfaces would remain clean and not degrade due to caustic chemicals. How does this affect design of the room, wardrobe, headwall, etc.?
Hand hygiene		High	Medium-High	Added numerous hand sanitation stations.
PPE donning/ doffing space	Droplet/ contact	High	High	Temporary ICRA barriers (negative pressure) were set up at unit entrances, primarily for donning and doffing PPE. ICRA vestibules were temporarily installed at the entry door of the OR (surge capacity use).
Convenient access to PPE	Droplet	High	High	Added numerous stations for mask distribution. Storage of high volumes of PPE was provided on mobile covered racks that were kept in hallways where volumes were greatest. Where feasible, offices and conference rooms were converted to storage rooms for more localized distribution. Enough PPE for 72 hours was maintained on hand. A storage room for these supplies was created to validate expirations. For future designs, storage should be considered: What is required for just-in-time delivery of supplies? What is stored on-site and what is stored off-site at a centralized warehouse? What scale is needed?

Table 1-8: Sample Solutions for the Built Environment Based on Risk *(continued)*

Facility Design Considerations	Hazard Being Addressed?	Priority	Risk	Other Notes, Specific Solutions
Air handling	Airborne	Low	Medium	All negative pressure rooms were not possible. Because CDC recommendations did not require every ICU bed to be in a negative pressure space, this was a lower priority. Alternative solutions were pursued, and portable HEPA air scrubbers were added to ICU rooms that were not negative pressure.
		High	Medium	A "viral mode" was created to revise the air-handling system to increase air changes by maximizing supply and return air. HEPA air scrubbers were used where patients were cohorted. All PUIs were considered to be on airborne precautions so spaces for these patients had the highest level of modification to existing AHU systems. Freestanding HEPA filtration units were installed in those areas as well.
		High	High risk of transmission during certain procedures	Intubation spaces (closed door) with temporary negative (slightly negative) rooms were created in trauma bays and triage spaces using existing HVAC and added mobile HEPA recirculation units.
Airborne infection isolation (AII) rooms	Airborne	Medium	Low (negative rooms required only for certain procedures)	The quantity of negative pressure rooms was derived from the air balance report. Although staff thought they needed additional negative rooms, the CDC only recommended them for aerosolization procedures. Due to existing mechanical limitations, alternate solutions had equally exceptional outcomes. Procedures were performed in "viral mode," non-negative rooms with air scrubbers. Patients who tested negative for COVID-19 but required medically necessary AII rooms were positioned in AII rooms on non-COVID-19 and non-PUI units.

hazards associated with exponential spread of disease and disease transmission. Some of the solutions had been previously identified as part of the HVA (e.g., morgue surge—set up sea boxes; ICU surge—convert non-functioning perioperative complex to ICU-level beds).

Solutions not implemented (e.g., 100 percent negative pressure ICU rooms) are also explained. While many solutions may be seen as operational, the built environment needed to support the proposed policy on both a large scale (e.g., capacity issues) and a small scale (e.g., hand sanitizer, temporary storage racks). It is also important to note that some hazards may include "no solution" as part of the risk identification process.

Existing Regulations and Potential Challenges to Adoption

Although health care is provided in some manner in multiple facility types, it is not necessarily appropriate to implement all considerations for facility hardening or emergency condition management. Some non-negotiable modifications will be driven by building codes specific to geotechnical, floodplain, and hurricane zones. For example, surge responses range from none to highly flexible or adaptable. Other modifications will be chosen by the health care organization in the context of their risk tolerance and other institutional factors. These decisions may be evaluated at the granular (individual facility) level or considered for a system of facilities, some of which would take a "turn the lights out" approach, while others would transform to absorb the shock of impacts from emergency conditions.

The origins of the SRA date back to 2001, and the awareness of the role of design in providing safe care continues to evolve. While some may consider its proposed addition as a component of the SRA to be more work, the DEVA takes advantage of a process that is already established in the *Guidelines* and leverages the HVAs already being conducted by health care organizations under the regulations of CMS and accrediting organizations. Even with multiple hazards to

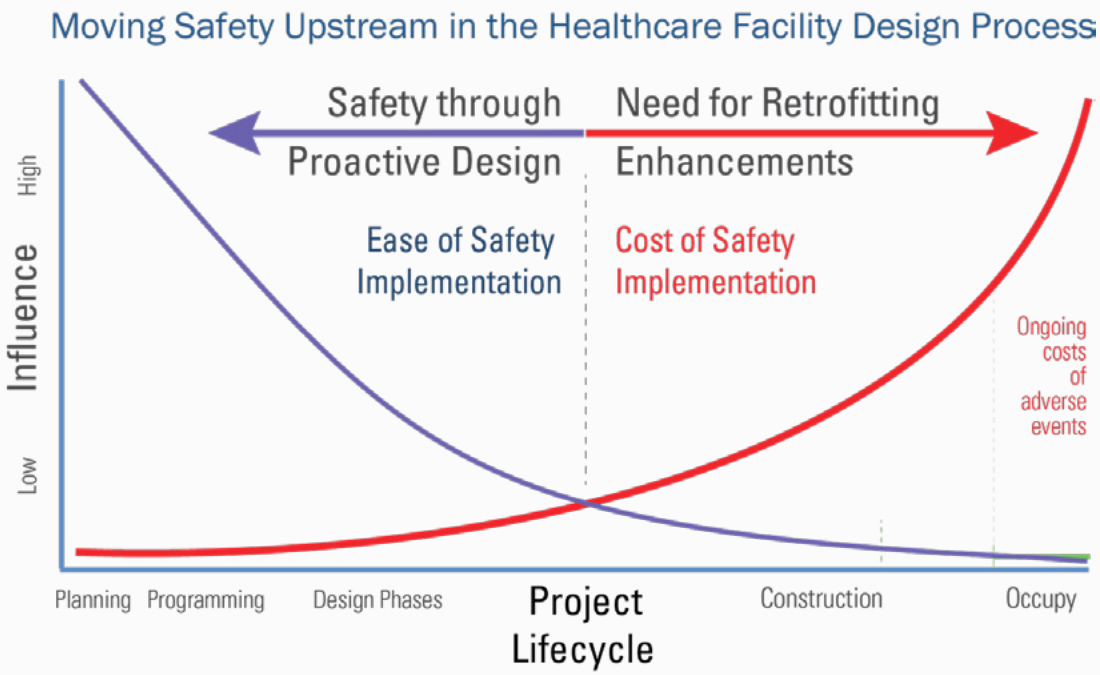
consider, health care organizations may find the groundwork for a DEVA has already been established. Identifying other departments or specialists in the organization that regularly advance plans for emergency preparedness can empower various stakeholders to more fully inform emergency preparedness decision-making, especially when there is an opportunity for capital investment such as a new construction or renovation project. Solutions will vary based on many factors and should leverage the availability of data and tools that are already available and regulations that are already in effect.

Importantly, the proactive approach to emergency preparedness can be understood in a benefit-cost model such as the cost-influence curve, which is widely used in the design industry. During development of the toolkit to support the SRA when it was introduced in the 2014 *Guidelines*, the cost-influence curve was used to illustrate that the most cost-effective influence on design decisions related to safety happens early in planning.[19] The further into design and construction a project gets, the less influence is possible and the more cost is involved to make changes. Nonetheless, once a building is occupied, the cost of responding to adverse events continues to impact the bottom line of the organization (Figure 1-6).

The challenge is in effectively evaluating multiple aspects of harm that may result from different types of hazards. A necessary recognition is that the evaluation of risk is subjective, and each organization has a different acceptance of risk. While risk matrices may be considered an oversimplification, they do serve the purpose of opening important discussions about the role of design in emergency preparedness. Zero-harm is a laudable goal, but it is highly unrealistic in the context of both unknowns and available resources.

In developing the framework for the DEVA, multiple emergency preparedness guides and tools were found and reviewed. However, many of these limited built environment considerations to critical infrastructure conditions such as water and electrical supply. The DEVA is the first attempt to systematically evaluate the many design decisions that can mitigate risk and influence the safe delivery of care during an emergency or disaster. While the

Figure 1-6: Cost-Influence Curve—A Proactive Approach to Safe Design



Source: Adapted from Taylor et al., "The Environment of Safe Care: Considering Building Design as One Facet of Safety" (2014)

assessment relies on use of quality data and careful thought during the development of solutions, good judgment is also subjective and can't be mandated. Further, dictating prescriptive solutions may be counterproductive and create a false sense of safety when solutions are adopted without considering them in the context of events and emergency operations plans. Providing a solution that cannot be operationalized is not really a solution. However, an understanding of how the physical environment can support an emergency operations plan is a benefit for everyone when there is less time to think, plan, and implement in the midst of an emergency event.

A Proactive Approach Yields Multiple Benefits

Identifying hazards and evaluating risks are crucial to designing for safety, and the goal of a safety risk assessment for health care

settings is to improve safety by mitigating the risk of hazards in the built environment that could directly or indirectly contribute to harm. By proactively taking a facility-based "all-hazards" approach to risk assessment during planning and design, organizations will be better prepared to respond to emergencies and disasters. The proactive approach has the potential to influence design decisions before construction, when costs are lower, with the benefit of both improved outcomes and cost avoidance in the life cycle of the building and organization.

Resources

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Endnotes

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Proposed Language Based on the 2018 Hospital *Guidelines*

Note: *Given that safety risk assessment language has already been established in all three Guidelines documents, the subcommittee recommends leveraging this existing language by incorporating (or refining, in the case of the Residential* Guidelines*) the need for emergency preparedness into the SRA with the addition of a disaster, emergency, and vulnerability assessment. This new requirement can be integrated into existing organizational processes for establishing and maintaining a hazard vulnerability assessment.*

The proposed new language below shows changes to the 2018 FGI *Guidelines* recommended by the risk assessment subcommittee of the Emergency Conditions Committee. Additions are underlined, and deletions indicated with a ~~strikethrough~~. Where an appendix item (i.e., a non-enforceable recommendation or guidance on applying a requirement) has been provided, an asterisk (*) precedes the section number (e.g., *1.2-4 Safety Risk Assessment). Appendix items can be identified by the letter "A" that precedes the correlating section number (e.g., A1.2-4 SRA). The text shown has been excerpted from the 2018 *Guidelines* and is not comprehensive. These proposed changes have been adapted and incorporated with recommended changes from other subcommittees in the draft *Guidelines for Emergency Conditions in Health and Residential Care Facilities* in the last section of this white paper.

***1.2-4 Safety Risk Assessment (SRA)**

> **A1.2-4 SRA.** The safety risk assessment is a multidisciplinary, documented assessment process used to proactively identify hazards and risks and mitigate underlying conditions of the built environment that may contribute to adverse safety events. These adverse events include infections, falls, medication errors, immobility-

related outcomes, security breaches, and musculoskeletal or other injuries. The SRA also includes assessment of the hazards and risks from natural and man-made emergency conditions. The SRA process includes evaluation of the population at risk and the nature and scope of the project; it also takes into account the models of care, operational plans, sustainable design elements, and performance improvement initiatives of the health care organization. The SRA proposes built environment solutions to mitigate identified risks and hazards.

***1.2-4.1 General**

A1.2-4.1 More information and online tools to assist in the development of a safety risk assessment can be found on the websites of the Facility Guidelines Institute and the Center for Health Design. As well, information about the SRA and the disaster, emergency, and vulnerability assessment can be found in the FGI white paper *Guidance for Designing Health and Residential Care Facilities that Respond and Adapt to Emergency Conditions*.

1.2-4.1.1 SRA Requirement

1.2-4.1.1.1 All hospital projects shall be designed and constructed to facilitate the safe delivery of care.

1.2-4.1.1.2 To support this goal, an interdisciplinary team shall develop a safety risk assessment.

1.2-4.1.2 SRA Components

See Table 1.2-1 (Safety Risk Assessment Components) to determine if the following SRA components are required for a project:

1.2-4.1.2.1 Infection control risk assessment (ICRA)

1.2-4.1.2.2 Patient handling and movement assessment (PHAMA)

1.2-4.1.2.3 Fall prevention assessment

1.2-4.1.2.4 Medication safety assessment

1.2-4.1.2.5 Behavioral and mental health risk assessment

1.2-4.1.2.6 Patient immobility assessment *(Not in Outpatient)*

1.2-4.1.2.7 Security risk assessment

1.2-4.1.2.8 Disaster, emergency, and vulnerability assessment (DEVA)

1.2-4.1.3 SRA Responsibility and Scope

The safety risk assessment shall be initiated and managed by the governing body during the planning phase of the project and shall evolve with additional levels of detail as needed to support the creation of a safe environment throughout the design, construction, and commissioning phases of a project.

*1.2-4.1.4 SRA Team

The governing body of the health care organization shall appoint an interdisciplinary team to conduct the safety risk assessment.

> **A1.2-4.1.4 SRA team members and roles.** The SRA team should coordinate all safety considerations and consolidate overlapping recommendations. See appendix table A1.2-a (Safety Risk Assessment Team Member Expertise) for a list of potential team members by SRA component type.

***1.2-4.1.4.1** The interdisciplinary team shall review the organization's hazard vulnerability assessment in conjunction with the development of a disaster, emergency, and vulnerability assessment (DEVA).

> **A1.2-4.1.4.1** The hazard vulnerability assessment should be shared with the design team at the earliest stages of

planning to confirm what has been established and where decisions should be reviewed with the design team.

1.2-4.1.4.~~1~~2 Members of the SRA team shall be convened as a group as needed to maintain continuity and integration of the SRA components.

1.2-4.1.4.~~2~~3 Individual members shall be engaged to develop additional detail according to their areas of expertise.

***1.2-4.1.5 SRA Process**

A1.2-4.1.5 SRA tools and methods. A range of high-priority activities to improve patient and caregiver safety outcomes should be considered during the predesign, design, and construction phases of a project.

***1.2-4.1.5.1 Identify hazards ~~and potential risks~~.** The governing body shall provide an assessment of the potential ~~harm to~~ hazards for patients, caregivers, and other users for the ~~risks~~ components listed in Table 1.2-1 (Safety Risk Assessment Components), identifying ~~the following: *(1) H~~ hazards specific to the project.

A1.2-4.1.5.1 ~~(1)~~ Hazards

a. Hazards include circumstances, processes, human activities, physical obstacles, and underlying conditions that may directly or indirectly contribute to harm to patients, staff, or other users or contribute to damage or loss. See appendix section A1.2-4.1.5.2 (Evaluation of underlying conditions that can cause adverse safety events) for more information.

b. Some disaster-related hazards may be more anticipated than others, for example, those with a regionally based likelihood. Anticipated hazards may come with some level of advance notice (e.g., minutes or hours

for a tornado watch/warning or a day for a potential hurricane landfall). Other hazards may be unanticipated (e.g., an explosion of stored chemicals, a terrorist attack). Some hazards may start as unanticipated and evolve into an anticipated event (e.g., a global pandemic).

~~(2) Historical data and/or national patient and caregiver safety trends relevant to the identified hazards~~

~~(3) Prioritization of the degree of potential harm to patients and/or caregivers from the identified hazards~~

***1.2-4.1.5.2 Evaluate ~~hazards and~~ risks from identified hazards.** The SRA team shall evaluate underlying conditions that contribute to an unsafe environment for the components listed in Table 1.2-1 (Safety Risk Assessment Components) and estimate associated risk considering both of the following: ~~.~~

(1) Likelihood (vulnerability), using historical data and/or national patient and caregiver safety trends relevant to the identified hazards

(2) Consequence (estimated degree of potential harm to patients and/or caregivers from identified hazards)

A1.2-4.1.5.2 Evaluation of underlying conditions that can cause adverse safety events

a. Underlying conditions include the physical environment, organizational and social factors, and task characteristics that can be affected by the design of a space, including the following:

—Noise

—Vibration

—Visual distraction and disorganization of space

—Light type, quality, and quantity for each location

—Surface characteristics for different spaces

—Indoor air characteristics for different spaces

—Sources of infection

—Ergonomics

—Staff fatigue

—Space required to accommodate functions

—Standardized locations for equipment (e.g., medical gas outlets on patient room headwalls, emergency call buttons)

—Opportunities for, and barriers or disincentives to, mobilization of patients

—Impediments to movement, maneuvering, and flow

—Communication systems

—Visibility of patients

—Automation (where possible)

—Support for family involvement in patient care

~~b.~~ For additional information, see the Center for Health Design report "Designing for Patient Safety: Developing Methods to Integrate Patient Safety Concerns in the Design Process," which identifies 10 environmental factors as "latent conditions that can be designed to help eliminate harm." Such "built environment latent conditions [holes and weaknesses] that adversely impact patient safety" should be identified and eliminated during the planning, design, and construction of outpatient facilities. The report can be found on the Center for Health Design website.

b. In the category of emergency preparedness, a hazard can include earthquakes, hurricanes, tornados, and other "natural" events. Hazards can also include terrorism, chemical spills, explosions, or other "man-made" events.

***1.2-4.1.5.3 Generate solutions.** The SRA team shall document proposed solutions that mitigate risks from the identified hazards.

A1.2-4.1.5.3 In the context of disaster and emergency preparedness, the solutions should be integrated into the organization's hazard vulnerability assessment.

***1.2-4.1.6 SRA Report**

After completing the SRA process, the governing body shall provide the following information and recommendations, which shall be incorporated into the planning and design documentation:

A1.2-4.1.6 SRA report.

a. Time and effort should be dedicated to patient and caregiver safety issues during the predesign phase (e.g., strategic planning, master planning, operational planning, and programming) of a hospital design project. The decisions made during predesign significantly affect the design parameters going forward and the safety outcomes of the project following occupancy. The safety risk assessment should be an important part of the continuous safety improvement program in any health care organization.

b. Requirements for submission may vary by AHJ and the SRA may not be required until permitting, but this does not preclude the benefit of early planning and documentation to ensure inclusion of integrated solutions that mitigate risk in the built environment.

c. Health care organizations are required by CMS and others to conduct hazard vulnerability assessments (HVAs). Design solutions that support the safe delivery of care during disasters and emergencies should be coordinated with and supplement existing mandated HVAs. The intent of the disaster, emergency, and vulnerability assessment portion of the SRA report is to proactively identify built environment solutions (beyond critical infrastructure) that mitigate risk from potential hazards addressed in an HVA.

1.2-4.1.6.1 Patient and caregiver safety hazards and risks identified by the safety risk assessment. See Section 1.2-4.1.5.1 (Identify hazards and potential risks).

1.2-4.1.6.2 Design features that contribute to the identified hazards and risks

1.2-4.1.6.3 Design strategies to reduce, mitigate, or eliminate identified hazards and risks

1.2-4.1.7 SRA Compliance

1.2-4.1.7.1 SRA documentation

(1) Written records shall remain an active part of the project documents for the duration of design, construction, and commissioning.

(2) The records shall include the SRA recommendations report and any documentation completed as part of the SRA process.

1.2-4.1.7.2 SRA communication

(1) The SRA team shall provide updates to the planners and designers for compliance with additional levels of detail generated during the project for all safety components listed in Table 1.2-1 (Safety Risk Assessment Components).

(2) Changes to the original design plans shall be documented, updated, and continually shared between the SRA team and the designers, planners, governing body, and contractor.

***1.2-4.2 Infection Control Risk Assessment (ICRA)...**

***1.2-4.3 Patient Handling and Movement Assessment (PHAMA)...**

***1.2-4.4 Fall Prevention Assessment...**

***1.2-4.5 Medication Safety Assessment...**

***1.2-4.6 Behavioral and Mental Health Risk (Psychiatric Patient Injury and Suicide Prevention) Assessment...**

***1.2-4.7 Patient Immobility Assessment...**

***1.2-4.8 Security Risk Assessment...**

A1.2-4.8.2.1 Security elements of the safety risk assessment

a. *Security considerations for project design.*...

b. *Security for emergency management.* Hospitals frequently provide both scheduled and emergency services, serve as part of local emergency response networks, and are expected to be functional, safe, and secure for patients, visitors, and staff while remaining prepared for natural and man-made emergencies 24 hours a day.

—The design of the facility should address the facility's role in responding to internal and external emergencies on its own or in coordination with local emergency response or public health authorities based on assessed risks. All other regulations for emergency

operations should be considered when developing the design.

~~—An all-hazards approach to design should be applied to help the facility prepare for, respond to, and recover from man-made events and natural disasters.~~

***1.2-4.9 Disaster, Emergency, and Vulnerability Assessment**

A1.2-4.9 Disaster, emergency, and vulnerability assessment (DEVA)

a. The DEVA should include information developed as part of any facility-based hazard vulnerability assessment, but it should more specifically address the emergency preparedness program as it pertains to proactive design or renovation of the facility.

b. An all-hazards approach to design should be applied to help the facility prepare for, respond to, and recover from man-made events and natural disasters. [Moved from A1.2-4.8.2.1 in the security risk section (see above).]

***1.2-4.9.1 Disaster, Emergency, and Vulnerability Elements of the Safety Risk Assessment**

A1.2-4.9.1 A range of hazards and vulnerabilities should be considered in performing a facility-based disaster, emergency, and vulnerability assessment. The DEVA should include, but is not limited to, the following:

a. Review of anticipated (e.g., earthquake, hurricane, nuclear facility accident) and unanticipated hazards (e.g., explosion, infectious disease, hazardous material)

b. Patient/resident/client population (e.g., acuity, functional needs)

c. Facility type and potential surrounding community assets (community assets in a rural area differ from those in a large metropolitan area)

1.2-4.9.1.1 Anticipated hazards. The SRA report shall identify anticipated hazards specific to a facility based on its geographic location.

1.2-4.9.1.2 Design features. Design features that provide resilience, hardening, flexibility, and adaptability during a disaster or emergency event shall be identified.

1.2-4.9.2 Disaster, Emergency, and Vulnerability Response

The design team shall incorporate the identified disaster and emergency-related design features in the project design documents.

Table 1.2-1: Safety Risk Assessment (SRA) Components

Assessment	Facility Type/Area	Project Scope	*Guidelines* Reference
Infection control risk (ICRA)	All	1. New construction 2. All renovations	1.2-4.2
Patient handling and movement (PHAMA)	Areas where patient handling, transport, transfer, and movement occur	1. New construction 2. Major renovation and renovations changing functional use of space 3. Minor and minimal renovations where patient handling occurs	1.2-4.3
Fall prevention	Any area to which a patient or family member has access	1. New construction 2. Major renovation and renovations changing functional use of space 3. Minor and minimal renovations where patient falls may occur	1.2-4.4
Medication safety	Medication safety zones	1. New construction 2. Major renovation and renovations changing functional use of space 3. Minor and minimal renovations where medication preparation, processing, and distribution occurs	1.2-4.5
Behavioral and mental health risk	Any area where behavioral health patient care is provided	1. New construction 2. Major renovation and renovations changing functional use of space to include care of behavioral health patients 3. Minor and minimal renovations where behavioral health patient treatment occurs	1.2-4.6
Patient immobility	Inpatient locations	1. New construction 2. Major renovation and renovations changing functional use of space to inpatient use 3. Minor and minimal renovations where inpatient care occurs	1.2-4.7
Security risk	All	1. New construction 2. All renovations	1.2-4.8
Disaster, emergency, and vulnerability	All	1. New construction 2. Major renovation and renovations changing functional use of space	1.2-4.9

Appendix Table A1.2-a: Safety Risk Assessment Team Member Expertise

EXPERT	SAFETY COMPONENT							
	Infection control risk	Patient handling and movement	Fall prevention	Medication safety	Behavioral and mental health risk	Patient immobility	Security risk	Disaster, emergency, and vulnerability
Clinicians from services affected by the project	✓	✓	✓	✓	✓	✓	✓	✓
Facility management staff	✓	✓	✓	✓	✓	✓	✓	✓
Performance and/or quality improvement experts	✓	✓	✓	✓	✓	✓	✓	
Safety specialists	✓	✓	✓	✓	✓	✓	✓	✓
Security specialist(s)					✓		✓	✓
Infection preventionists	✓	✓		✓			✓	✓
Architects, interior designers, and/or engineers	✓	✓	✓	✓	✓	✓	✓	✓
Human factors specialists	✓	✓	✓	✓	✓	✓		
Emergency preparedness officer/ representative								✓
Risk manager	✓	✓	✓	✓	✓	✓	✓	✓
Insurance provider							✓	✓
Other appropriate individuals based on nature of the project	As needed	As needed	As needed	As needed	As needed	As needed	As needed	As needed

Chapter 2: Surge Capacity Considerations

In the context of emergency conditions, health care "surge" is defined as an unplanned, temporary increase in medical need in an affected community that exceeds the planned capacity of a particular health or residential care building, facility, or system. A surge event in a particular location often has a cascading effect on a larger health care system. This chapter focuses on an organization's ability to meet surge demand by increasing capacity at affected facilities and, when necessary, at other locations on the organization's property.

This chapter does not cover scheduled events, such as those associated with construction or planned disruptions. Scheduled events typically allow facility administrators to organize processes that assure safe delivery of care during the specified timeline. With that distinction in mind, this chapter considers the impact of unscheduled events, both predictable and unpredictable (see Table 2-1), and the potential effects and mitigations of each.

Table 2-1: Examples of Events That May Cause a Surge in Demand for Health Care Services

Event Type	Scheduled	Unscheduled	
		Predictable	Unpredictable
Short-term	Utility switchover	Equipment failure	Fire Active shooter
Medium-term	Relocation	Seasonal flu	Isolated natural disaster Mass casualty event Hazardous material incident Explosion
Long-term	Long-term construction	Flood Hurricane Wildfire	Pandemic

While many surge events are predictable to a degree, elements of unpredictability should always be accounted for during project planning. For instance, most equipment operating beyond normal working conditions or the lifespan of the equipment could be susceptible to unplanned failure. Likewise, seasonal infectious activity (e.g., influenza) could cause variations in 24-hour bed needs.

Health care organizations can plan for hyper-local impacts (e.g., floods, train derailments) and/or broader regional concerns (e.g., tsunamis, earthquakes, hurricanes) by evaluating hazards based on their geographic location during early stages in project planning. Established risk registers, such as the U.S. National Hazards Index[1] from the National Center for Disaster Preparedness at Columbia University, can help organizations anticipate hazard potential. The National Hazards Index interactive map combines the risk levels for any number of potential weather-related disasters. Regardless of whether an event is planned or unplanned, a force of nature or human action, each event has a corresponding set of needs and complications.

Adaptable and well-functioning health care delivery systems are critically important and deliver tremendous value to their communities. Therefore, private and public agencies should share the joint goal of creating emergency response systems that are broadly adaptable. This chapter outlines a set of surge considerations intended to facilitate provision of the best possible care by organizations of varying size, assets, and event vulnerability. Ultimately, these considerations assist in:

- Planning for an emergency event
- Providing safe harbor during an event
- Maintaining the standard of care during surge events
- Performing post-surge evaluations

Acknowledging that the physical environment may be altered during a disaster is not a new concept. Federal, state, and local governments have all recognized the challenges of providing ordinary care during extraordinary circumstances. Physical environment standards, such as building and engineering codes, prescribe minimum requirements for a building that is planned and designed for a specific purpose and anticipated to function under typical operating conditions. These codes and standards also have provisions for alternate support systems if the primary components of the physical environment should fail.

Building and engineering codes affect the design of health care facilities in many ways. For example, hospitals are:

- Designed with multiple smoke compartments to enable patients to move from a typical care location to an alternate location during a smoke or fire event.
- Constructed with electrical systems that have a redundant power source (e.g., if primary utility power fails, an alternate generator provides backup power).
- Required by the Centers for Medicare & Medicaid Services to create disaster plans to reconfigure or even evacuate a facility in order to continue providing appropriate care.

Implied in all of the above is the concept that health care organizations are expected to respond rapidly and effectively to all emergencies. Events evolve quickly, and administrators must react with haste to prevent further loss. When planning for an emergency event is possible, alternatives to providing care in the intended space can be broadly established and the need for immediate oversight by an authority having jurisdiction (AHJ) prearranged. For example, established emergency protocols dictate that hospitals are not required to seek regulatory approval to relocate patients in the event of a fire; rather, they are expected to act quickly to protect patient lives. Similarly, the local electrical authority is not required to approve a switchover to backup power generators—this happens automatically, without human intervention. This same concept also applies to facilities where surge capacity is exceeded immediately following a significant event.

Unplanned and unpredictable events often leave very little time to prepare. Many regulatory authorities lack the capacity to respond and provide substantive guidance to immediate-need circumstances (e.g., a tornado that hits in the middle of the night, a bomb threat on a weekend). Therefore, it is essential that health care organizations keep their disaster, emergency, and vulnerability assessment (DEVA) and emergency operations plan up-to-date. This allows a health care organization to take immediate action during a surge event without waiting for regulatory approval.

The number of days this short-term grace period should last is highly dependent on the event and the AHJ. Regardless, events that require alternate care strategies and/or accommodations should be reported as soon as possible to the appropriate AHJ. Working closely with the local AHJ is the best way to assure health care organizations do not create non-compliant spaces or follow non-compliant practices during a longer surge event.

The alternate standards of care listed previously (e.g., patient relocation to adjacent smoke compartment, backup emergency generator) are widely accepted because they exist in codified rules and standards. An argument can be made that similar rules and standards could be established to govern other emergency events

and crisis standards of care. An effort to establish a national consensus document with minimum crisis standards specifically for the physical environment would give health care regulators, facility owners, and designers the ability to:

- Plan for an event and have a basic understanding of the financial impacts of planning options.
- Make rapid decisions in the immediate aftermath of an event.
- Mitigate risks while operating under resource and time limitations.

Any such effort must accept that disasters and facilities are diverse and that a "one size fits all" approach could inhibit effective responses.

Surge Capacity Subcommittee Process

The surge capacity subcommittee met weekly throughout the summer of 2020 to review how various hospitals and hospital systems handle surge events. The group's initial task was to define "surge." The resulting definition, shown in the first paragraph of this chapter, guided the subcommittee's work and consideration of how events that begin outside a hospital or health care system might create a domino effect that eventually disrupts the operations of an entire system.

The surge capacity subcommittee, a diverse group of medical providers, hospital administrators, AHJs, architects, and engineers, conducted interviews with various institutions throughout the United States to gain an understanding of how each institution handles different types of emergency surges in their hospitals and/or health care systems.

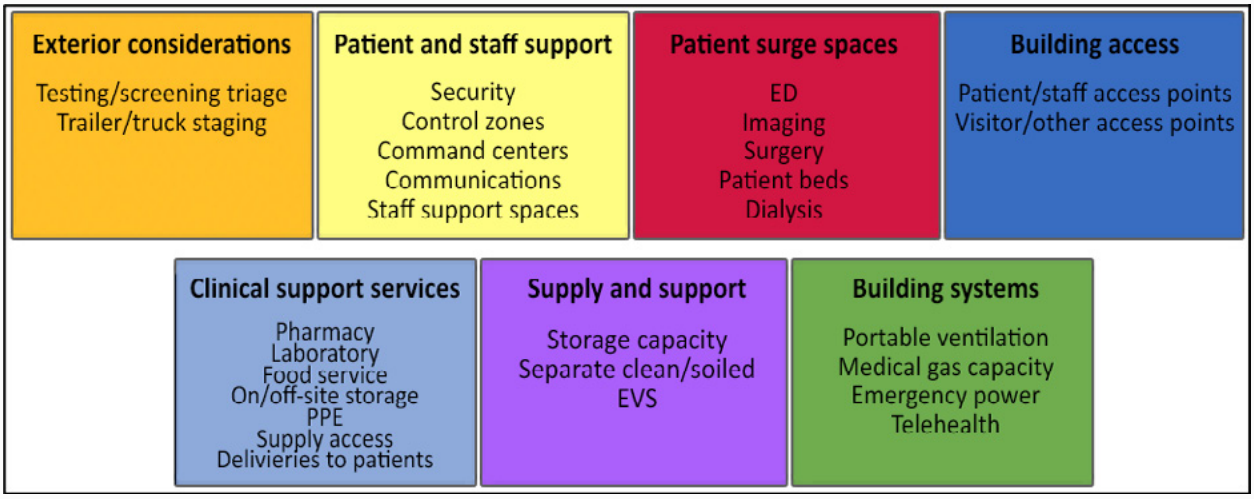
The narratives produced by these interviews became the focus of the subcommittee's work. Many reflected common themes, such as the necessity of anticipating different ways to communicate and expediently coordinate care during surge events. Facility representatives also emphasized the need to:

- Provide testing and diagnostic space in unanticipated locations.
- Create or designate space for an emergency operations center.
- Evaluate on-site supply storage and distribution systems and modify if needed.
- Locate surge patients in areas not designed for critically ill or injured patients.
- During infectious disease events:
  - Protect staff by providing sufficient personal protective equipment (PPE).
  - Create separate paths of travel for supplies, staff, and patients.

Many health care organizations reported that emergency plans previously developed for their institutions may not have effectively addressed preparedness for large-scale infectious disease events with initially unknown treatment needs such as the COVID-19 pandemic. What's more, the plans weren't created with the flexibility needed to allow facility administration to anticipate the long-term impacts of decisions made in response to immediate needs. Gathering these firsthand accounts from representatives of affected facilities enabled the subcommittee to identify emerging trends and solutions that could be helpful to a wide array of health care organizations.

Focusing on these narratives of successes and failures, the subcommittee evaluated where and how different types of surge events may impact patient care and the supporting infrastructure. The resulting recommendations for existing hospitals and/or health care systems may be based on the duration of the event, the available resources, or the shared experience of what worked for a similar type of institution. These recommendations should be considered when health care organizations renovate existing or build new health care spaces.

Figure 2-1: Surge Subcommittee's Areas of Focus



The surge capacity subcommittee identified seven areas of focus that represent common themes from the interviews, research, and collective knowledge of ECC subcommittee members. The following questions guided the subcommittee members as they conducted interviews:

1. What has your organization identified as a surge capacity issue? Does this issue relate to different types of solutions or to more than one type of emergency event?
2. How has your organization addressed issues of surge in the past?
    a. Did these solutions work as intended? What takeaways could be relevant to other organizations?
    b. Were the solutions internal to the facility? Was there enough information and time to evaluate the costs of potential solutions?
    c. Were the solutions appropriate to the size and type of facility?
    d. Did solutions change based on the timeline of the event? How?
    e. What lessons were learned from the surge event?

3. Could changes to the FGI *Guidelines* help health care providers and designers address surge capacity issues more effectively? If so, what changes might you recommend?
4. Are there operational considerations that could improve or enable space use efficiencies during surge events?

Due to the widespread impact of the COVID-19 pandemic, it quickly became clear from the subcommittee's interactions with health care organizations that this chapter would focus primarily on the overwhelming needs associated with this event. The subcommittee recognized the pandemic as a critical opportunity to explore, record, and share stories of how health care organizations adapted to the crisis. We expect this information will be useful in planning for future emergency conditions of various types that may cause surge events.

Exterior Considerations

When possible, exterior spaces on health care facility sites are routinely leveraged for surge support during disasters. Access to exterior spaces is not available at all facilities, especially those in dense, urban areas, but facilities that do have them have successfully used parking lots, garages, lawns, and sidewalks to provide relief from patient surge. Although these spaces are not typically an active component of the care environment, extreme disasters may require extreme creativity, and converting spaces normally accessible to the public for short-term medical purposes can help a facility adapt to a surge situation.

When properly planned and deployed, exterior spaces could be used to:

- Create a buffer area between the arriving public and critical care locations.
- Set up a triage and sorting area for arriving patients to separate those who are injured from those who are sick.

- Establish a testing area for patients, staff, and the public during an infectious disease event.
- Provide additional support capacity and staging for supplies and waste.
- Create additional patient care locations.
- Set up temporary staff support areas.

The use and utility of exterior spaces will vary depending on the facility location, availability of extra assets, and specific patient needs. Table 2.2 provides a simple format that organizations can use and adapt when considering which departments or areas are suitable for relocation outside the building. Of course, it is generally easier to provide key environmental support inside the hospital building. Therefore, infrastructure-intensive spaces (e.g., intensive care unit, surgery, trauma) should remain within the building envelope. Spaces that require less infrastructure are easier to move into tents or mobile units; the alternate care sites chapter in this white paper provides detailed information on various temporary structures. The potential alternate care sites discussed in the chapter include non-health care facilities in the community (e.g., arenas, convention centers) as well as tent and modular structures that may be suitable for deployment on-site at a health care facility that is experiencing a surge event.

Table 2-2: Sample Quick Analysis of Infrastructure Needed for Support

Function	Critical infrastructure needed			
	HVAC	Electrical	Med/gas	Security
Intensive care	x	x	x	x
Pharmacy	x	x		x
Administration		x		x
Emergency department	x	x	x	x

Converting Exterior Areas to Support Areas

This section reviews several support functions that could transition to exterior spaces during surge events. Both existing infrastructure and temporary built environment components are needed to make these transitions successful. As well, potential "off-site" partnerships that could enable hospitals to extend these functions to adjacent properties and into the community are helpful.

Access and sorting

When surge events force health care organizations to operate beyond their existing buildings, the first consideration should be access and egress. Facility entrance points may move from the front door of the building to the perimeter of the property. The exterior grounds may become the lobby, loading dock, and queueing areas.

The need for access to and egress from a facility can be divided into four main categories:

- Ambulances and first responders
- Supplies, waste, and soiled materials
- Staff, vendors, and contractors
- Self-delivered patients, including routine patients and the walking wounded/worried well

Each of these access points may be exclusive of others. A health care organization is likely to have better control over the first three situations because the last—non-ambulance patient arrival—is the least predictable.

In planning for access and egress during an emergency event, health and residential care organizations may benefit from completing a comprehensive inventory of site assets and a DEVA. The DEVA should establish or review existing plans for converting circulation zones and roadways into exterior support areas if a significant surge event occurs. It is imperative for health care organizations to understand how an emergency event could affect site circulation

and have a plan to work around any limitations of the site when planning for alternate use of exterior spaces.

Organizations should have a plan to address the following site needs when planning for emergency conditions:

- A wide turning radius for tractor trailers where supplies will be delivered
- Fire lanes and access for fire department equipment that can remain open and accessible
- Access to fixed supply points, including:
  - Generator refueling
  - Medical gas and emergency oxygen supply connections
  - Fire hydrants
- Access (including the helicopter approach) to permanent or temporary helistops if the DEVA indicates they are needed. Provision of this access will need to be ensured during the planning phase.

When conducting the DEVA, health care organizations should include provisions to ensure the site will remain accessible during an emergency event. Use of a one-way traffic flow has been shown to be a successful transportation strategy to reduce backups. Dedicated off-site parking for staff can make traffic more predictable, but shuttles will need to be provided and their schedule planned to accommodate facility staffing requirements.

Access to loading docks may become difficult if the loading docks become crowded with supply storage. Therefore, alternate loading and unloading spaces should be considered, especially if storage moves to temporary locations on-site. Other possible impacts include lower elevation parking lots that become flooded, trees that are downed, and debris that blocks roads. Numerous unplanned variables could contribute to the obstruction of site access or use. Organizations that are forced to manage unplanned variables in the midst of an emergency are likely to find their opportunities for remedy are limited.

One of the least predictable variables is the arriving public. When appropriate to the emergency condition, allowing the public to sort by acuity level will be valuable. Coordinating arrival points with local officials could help leverage temporary signage that encourages the arriving public to select destinations and travel routes for maximum effectiveness. Health care organizations should regularly assess the signage options in their area. For example, during an emergency, it may be beneficial to appropriate an interstate digital billboard for delivery of real-time disaster information and routing instructions.

Patient screening/triage

During the peak months of the COVID-19 pandemic, screening patients and managing those with positive results was a challenge. Initial screening typically included various forms of data collection: visual assessments, interviews, checking of vital signs, all of which were compared to an increasingly complex and frequently changing diagnostic algorithm. In addition, the testing technique required (e.g., the nasopharyngeal swabbing required for COVID-19 testing) generated an increased risk of transmission and thus required specific environmental controls during sample collection.

The triage process is often rapid and intuitive. However, the gold standard during infectious disease events is microbiological testing, which is more complex, invasive, and time-consuming than typical screening. Recent experiences have revealed that these comprehensive tests may be in limited supply or completely unavailable, especially during the early phase of an emerging infectious disease event. Inviting both potentially infected and uninfected people to the same physical location for screening creates obvious risks.

During the COVID-19 pandemic, many emergency departments (EDs) managed patient flow using traditional means (i.e., using facility spaces to separate symptomatic patients from asymptomatic patients, including those deemed the "worried-well"). During pandemic events, this screening may best be performed outside the building, especially for rapid evaluations. Pushing initial assessment

outside the health care facility itself can prevent overcrowding and prevent or reduce the spread of infection.

Figure 2-2: Triage Tent at Hospital in Boston

Source: NBBJ

On-site exterior spaces have been used at many facilities during emergency conditions to set up tents and other temporary structures where screenings could take place. When faced with such surge events, it may make sense for health care organizations to hire local vendors to set up tents adjacent to the ED entry for walk-in patients requiring testing.

Case Study: Rush University Medical Center, Chicago

In the early months of the COVID-19 pandemic, Rush University Medical Center in Chicago converted its ambulance entry court to a triage area, enabling the separation of symptomatic and asymptomatic patients. To enable the ambulance bay to function as a patient screening area, the hospital rerouted ambulance traffic and retrofitted the bay with tents for patient care and technology upgrades such as additional electrical and data lines for lights, computers, printers, and phones. To support infection prevention practices, the organization also provided three portable sinks, two portable toilets (one for patients in triage and

one for patients suspected of being infectious), and screens to guide patients through the appropriate flow stream.

The interventions described above were used to address the unique scenario presented by the COVID-19 pandemic. Triage takes on a significantly different appearance in other emergency conditions, whether natural or man-made. Earthquakes, mass shootings, tornadoes etc., may all generate a surge of trauma victims who require rapid interventions. In these situations, solutions such as Rush University Medical Center's conversion of the ambulance bay could help health care facility staff transition patients from assessment through treatment in much less time than is required during normal conditions.

Planning considerations for patient screening/triage should include provisions for:

- A one-way flow of patients in and out of the triage area
- Space to facilitate appropriate physical distancing for waiting and processing areas
- Clear signage with instructions for patient processing and infection precautions
- Staff and patient security (e.g., security cameras in exterior triage areas)
- Infection prevention measures (e.g., hand-washing and/or hand sanitation stations, space to don/doff PPE, space to store unused and used PPE)
- Climate control (e.g., protection from heat, cold, wind, or precipitation)

Controls such as these allow hospitals to limit facility access to essential personnel and patients who meet screening criteria. Potentially infectious patients could be directed to designated clinics or inpatient units for care. While triaging patients outside the health care facility is not an ideal solution, during infectious disease surge events it can be more effective for reducing disease transmission and protecting staff and the worried-well than triaging in an overcrowded ED.

Figure 2-3: Triage Booth Outside Yangji Hospital on March 17, 2020, in Seoul, South Korea

Source: AFP, https://www.straitstimes.com/asia/east-asia/south-korea-dials-up-coronavirus-testing-with-hospital-phone-booths

South Korea developed a new testing approach to protect staff—individual testing booths with negative pressure. Clinical staff administered questionnaires via intercom and swab tests via rubber arms into the testing booth. Similar testing booths were used in American hospitals. As in any other patient care space, the booths must be thoroughly cleaned between patients to reduce the opportunity for disease transmission.

While such testing booths are a unique and interesting solution, most organizations during the COVID-19 pandemic relied on drive-through testing, where clinical staff equipped with full PPE completed preliminary questionnaires and performed diagnostic tests while patients remained in their cars. Similar scenarios occurred in recent measles outbreaks where patients and families were encouraged not to leave their vehicles and risk contamination of the clinic waiting room. Many drive-through testing sites were set up off-campus, limiting the burden on both the patient and the campus. With the increasing use of telemedicine, health care

organizations may soon be able to rely on this technology to pre-sort patients before they arrive on-site.

Areas for Hazardous Materials Decontamination

When a hazardous materials (hazmat) contamination event occurs, it typically necessitates immediate removal of chemicals or radioactive materials from a patient or patients. To prevent further contamination, this is typically done before the patient enters the emergency care environment. The FGI *Guidelines* documents for hospitals and outpatient facilities require location of a human decontamination room equipped with a shower and an exterior entry near the emergency entry, but at least 10 feet from the nearest entrance. This requirement is intended for sporadic low-volume use and assumes that contaminated individuals will first seek treatment at the emergency department.

Large-scale hazmat events will quickly overwhelm this single human decontamination room, which is why many organizations also create a plan for exterior mass decontamination. Portable tents and containment devices are convenient solutions that allow for quick removal of waste and effluent. Portable units can also be taken off-site, decontaminated, repacked, and returned with less burden and downtime for the primary health care facility.

Portable Staff Support Areas

Any health care facility is threatened when basic staff support service spaces are not provided in a way that encourages their use. It is often easier, quicker, and safer to convert staff support areas into patient care areas than it is to create a temporary environment suitable for patient care outside the facility. Because this surge solution may lead health care organizations to relocate staff support spaces to tents or other temporary structures elsewhere on campus, it is important for health care organizations to create a plan that balances patient needs with staff needs.

One benefit of relocating staff support spaces could be that physical separation from care environments facilitates critically important respite for care providers, as long as these spaces are conveniently located and can be quickly accessed by staff. Certain staff functions are better suited for relocation, for example, staging, cooking, dining, and sleeping can be adequately accommodated without requiring significant infrastructure. Likewise, portable kitchens, toilets, and showers are readily available from commercial vendors, and their use should be considered in an organization's DEVA.

Specialized functions can be quickly accommodated in portable structures and tents, especially when they are designed for that purpose. Health care organizations should consider working with local vendors to make plans to provide such temporary structures during emergency conditions.

Storage Trailers/Space

Unfortunately, some emergency events may tax a facility's morgue capacity. Existing body refrigeration has finite capacity and is dependent on the space and cooling capacity of the room. During the COVID-19 pandemic, storage trailers were a common—although admittedly less than ideal—solution when morgue capacity needed to be increased temporarily. When used, a great deal of sensitivity should be given to the location of such a trailer and provisions should be made to ensure it is shielded from patient, visitor, and staff view. As well, security and a discreet means for body transport should be provided.

One health care organization interviewed during the COVID-19 pandemic purchased three tractor trailers for future use. Whereas the example of refrigerated trailers serving as morgue spaces was the result of extraordinary circumstances during the pandemic, refrigerated trailers are more likely to be used to store perishable goods or food during times of crisis (e.g., weather-related events). Having such provisions ready to deploy would enhance an organization's emergency preparedness and resiliency and add value to the community.

Storing clean and sterile clinical supplies also can present a challenge during an emergency event. These supplies typically have manufacturer recommendations or commonly accepted practices for environmental conditions (e.g., positive pressure, temperature range, relative humidity levels) in the storage space. Where these environmental requirements can be met in a temporary structure, this solution could be appropriate for staging/storing clean and sterile supplies. However, where this approach is adopted, consideration must be given to protecting these supplies during transport from the temporary storage location to the facility.

Waste and recycling storage have fewer prescribed controls than clean supplies, but suitable accommodation must be made to prevent odor, intrusion by vermin, etc. Locating waste and recycling storage areas near supply delivery areas and along accessible circulation paths will increase use.

External Wayfinding

Wayfinding is a critical component of disaster operations. Even people who are familiar with a given health care facility or campus may require clear direction through any new and/or temporary locations used during emergency conditions. People unfamiliar with the health care facility might be confused not only by the site layout and signage, but also by the potential masses of people and vehicles present during an emergency event. Thus, wayfinding becomes a critical element for reducing confusion and improving efficiency during emergency conditions.

When health care organizations deploy tents, modular structures, and/or other temporary structures during surge events, existing traffic and pedestrian patterns are likely to be altered as a result. Accordingly, wayfinding solutions should be designed to provide flexibility for different situations. Although not commonly used at present, programmable signage and portable, electronic displays can be particularly useful during emergency conditions. For facilities where such technology is employed, alternate signage and wayfinding programs could be planned and provided to redirect people and

vehicles as events develop in real time. For facilities with traditional signage, any temporary placards used should be weather-resistant, large, and easily distinguishable from other wayfinding indicators. Organizations should consider installing temporary signs on top of conflicting or otherwise confusing signs during surge events.

Security

Interviews conducted by the subcommittee revealed that emergency conditions may require health care organizations to limit access points to their facilities, depending on the emergency. Pandemics and chemical and radiological events are dramatic examples during which arriving patients may bring harmful microorganisms, fumes, or contaminants into the facility if not properly routed through a decontamination or containment process. One facility interviewed reduced entry points from 18 to 4 in response to the COVID-19 pandemic. Fortunately, building codes have long recognized the need for access control in health care structures. Current codes provide several options for electronically monitored and controlled hardware.

Perimeter security

When organizations relocate patient care and support spaces to the exterior campus, the security perimeter will expand and security protocols must encompass the additional risks that result. Video surveillance, lighting, and fencing installations can be used to increase security and provide temporary wayfinding cues. Organizations may find it helpful to visually define new patient and staff zones on the campus using fence structures. When these additional security measures are not available to a facility, the organization may consider implementing security patrols in these zones. When planning site and landscaping design or conducting a DEVA, owners and designers should consider the crime prevention through environmental design (CPTED) approach (see International CPTED Association[2] for more information). Environmental design integration is one approach that can help support the flow of people in and out of the hospital campus while reducing on-campus criminal activity.

Control zones

Health care organizations may find benefit in defining specific control zones on their campus. Defining these zones could be as specific as identifying the location and size of predetermined temporary emergency condition units or as general as labeling potential uses based on proximity to a primary building, vehicle access points, or utility access points or compliance with fire separation requirements from other structures or hazardous storage areas. The former approach provides an out-of-the-box actionable plan, while the latter provides degrees of flexibility for various emergency events. Either way, having a clear understanding of temporary utility access points, as well as limitations on piping or cabling that can extend utility services, is necessary. For example, facility and operations managers might question how far a temporary oxygen supply can be from an emergency oxygen supply connection; the answer then informs where these services should be placed on-site.

Planning for specific zones will generally help organizations identify more opportunities. For example, the replacement Landstuhl Regional Medical Center for the U.S. Army in Germany was designed from the ground up to accommodate surge capacity needs. Surge considerations at this facility include:

- Predefined locations for the addition of temporary structures on the campus
- Provision of essential utility services (e.g., electricity, water, waste management) to these locations to create plug-and-play capabilities that can be quickly and safely deployed and managed
- The ability to rapidly convert a clinic adjacent to the hospital to manage patient intake, screening, and triage
- Roadway access to each area designated to receive patients

Temporary Structures

Temporary structures such as tents can provide rapid access to additional capacity, but they are not intended for long-term use.

Due to their inherent structural and environmental weaknesses, even short-term use—particularly during some extreme weather events—may not be viable. For instance, temporary testing tents that provide sufficient protection during the summer may not be able to withstand significant snowfall in the winter. Likewise, poorly insulated structures may struggle to maintain comfortable temperatures in areas prone to temperature extremes (e.g., summer in the American Southwest or winter in the Great Lakes regions). Temporary structures also may not protect patients and staff from excess noise (e.g., a busy road, temporary construction site, helicopter landing zone); it is therefore recommended that the acoustic conditions of such structures be considered when conducting the DEVA.

One design concept considered by the U.S. Department of Defense is a transportable, structurally sound building that can be modularized, scaled to fit the event, and pre-positioned in strategic locations. Deploying this type of structural technology could be extremely cost-effective as it could provide shelter from the weather and HVAC systems that can adapt to positive and negative airflow needs. Ideally, these structures would be easy to assemble (requiring hours rather than days) and designed for flat packing to promote easy storage and transportation.

Many vendors offer these types of modular structures, especially in the wake of an emergency event. Options can be overwhelming, and they may come at a time when health care organizations have limited capacity to determine which structures are the best fit for their site. These structures also may not be fully code-compliant so organizations must work with local code officials to ensure the solution will meet safety requirements. For more information on modular solutions—including a recommendation for pre-approved health care modules—refer to the alternate care sites chapter of this white paper.

Building Access

During certain emergencies, it may be necessary to restrict access to the facility in its entirety or to certain areas in the facility. While

"surge" typically refers to a surge of patients needing care, it can also apply to an influx of family members seeking information or reunification after an emergency event as well as other emergency-related visitors, including curious onlookers or media personnel. Some emergencies call for hospitals to severely limit movement in and around their facilities to protect staff, patients, and visitors alike.

During the COVID-19 pandemic, the first thing many care organizations did was close entrance and exit points to their facilities. By limiting access at these points, staff could more easily monitor and direct the flow of patients, visitors, and staff at designated entry points. The closure of elevator banks further limited the movement of patients and visitors through the building, although staff elevators typically remained functional.

Interviews by the surge subcommittee revealed that some hospitals divided building access into distinct operational segments during the pandemic. Examples of these segments include:

- **Access for patients.** Patients were screened before entering the hospital. In some cases, patients who screened positive for COVID-19 were directed to their primary care physician.
- **Access for visitors.** Visitors were limited to either one parent accompanying their child or an assistant for a patient with special needs. Others were asked to wait in various locations. One hospital used a large waiting area with physically distanced seating. Another used a designated "cell phone parking lot," similar to the type available at airports. Visitors were not allowed to wait in cafeterias or other public areas in the hospital.
- **Access for staff.** Staff were screened daily and required to show identification for access. If diagnosed with COVID-19, staff members were sent to employee health services or followed the established facility protocols. When the pandemic ebbed in a facility's geographic area, staff were permitted to perform daily self-screening via a phone application that provided digital confirmation to allow them entry to the hospital.

- **Access for all others.** Access for contractors, vendors, and delivery personnel was limited to those providing essential services, such as food and medical supply deliveries or emergency repairs. Construction projects should be evaluated and allowed to continue if access can be provided without endangering staff, patients, or the construction team. Contractor and vendor personnel should be screened and have on-site protocols in place for physical distancing.
- **Testing.** Every person was tested before entering a hospital. These screenings included questionnaires about general health and, in some facilities, temperature-taking by facial scan or handheld sensor to eliminate physical contact between people. A large hospital system in Pennsylvania deployed a new, wall-mounted temperature technology that was automated to capture the temperature of each staff person entering the building.[3] Depending on the outcome of the scan, people were either sent home, directed to a testing facility, or admitted. Some organizations had separate testing facilities for staff and patients or visitors.
- **Testing facilities.** The overall layout of testing locations varied widely among health care facilities, although most made use of external tents. Tents primarily functioned as either walk-up or drive-through testing facilities. Fewer organizations had the ability to provide safe and physically distanced testing within their facility.

  Testing facilities were often divided between staff and patients. In general, patients undergoing procedures or surgeries were tested prior to receiving treatment.
- **Reopening**. When COVID-19 infection numbers receded in a given region, some health care organizations began resuming certain health care services while continuing to practice physical distancing, require masking, and perform regular surface disinfection. At some facilities that resumed normal patient services, use of questionnaires, temperature testing, and limits on visitors were continued.

Patient Surge Spaces

Surge capacity affects all functional aspects of a hospital, but perhaps none more visibly than patient care areas. Simply put, when the spaces designated for patient care have reached capacity, additional space must be provided. Some organizations' emergency operations plans may already take this situation into account, but when emergency conditions inundate health care facilities with an influx of critical patients, every bit of existing space is suddenly under consideration for use. Surges during the COVID-19 pandemic presented additional challenges for virus containment and medical gas accessibility. While the information in this section highlights topics related to the pandemic, opportunities to flex and grow patient care areas will also be pertinent to other emergency conditions.

The initial peak of the COVID-19 pandemic in the United States began in April 2020 in New York City. In two months, the New York City Department of Health and Mental Hygiene reported 173,288 COVID-19 cases, 43,676 hospitalizations, and 13,938 deaths.[4] The modern U.S. health care system had never faced patient surge conditions of this magnitude. Hospitals that surged with critically ill patients were quickly challenged by operational issues (e.g., triage decisions, staffing shortages), supply chain management concerns (e.g., medical gas shortages, not enough available PPE, limited testing supplies), infection prevention concerns (e.g., initial lack of clarity on transmission, limited ability to convert standard patient rooms to negative pressure rooms, lack of shower facilities for staff), and patient care concerns (e.g., ventilator management, dialysis, patient positioning).

Two overriding challenges many hospitals experienced throughout the pandemic were a shortage of acuity-appropriate beds for the number of quickly deteriorating patients and the ability to isolate COVID-19 (or presumed COVID-19) patients. As the number of cases increased exponentially, emergency departments quickly became congested and inpatient units rapidly reached capacity. Furthermore, the aggressive nature of the respiratory virus left many patients in need of intensive care and mechanical ventilation

for prolonged periods, stressing the intensive care unit (ICU) and ventilator capacity of hospitals.

Repurposing Existing Spaces to Increase Patient Care Areas

To confront the challenges of a shortage in patient care spaces, many hospitals implemented phased plans for increasing bed capacity in ICUs and other departments. These plans included options such as reactivating patient rooms that were either not being used or had previously been repurposed; converting pediatric units to adult care; converting medical/surgical units to ICU units; and converting non-licensed beds (e.g., post-anesthesia care unit [PACU] bays, observation units) to inpatient bed use. The circumstances became so dire at some hospitals that operating rooms were being used as patient care rooms.

To increase capacity of medical/surgical beds in COVID-19 units, some hospitals housed two COVID-19 patients in a single-patient room. During the first few months of the pandemic, the Massachusetts Department of Public Health posted a bulletin stating that for the duration of the pandemic, a licensed facility in which a single-patient room was converted to a multiple-patient room had to meet the following minimum requirements:

1. Each patient bed must be equipped with one oxygen outlet and one vacuum outlet.
2. Each patient bed must be spaced at least 6 feet from another bed.
3. Each patient room must have access to hand-washing sinks and privacy partitions.[5]

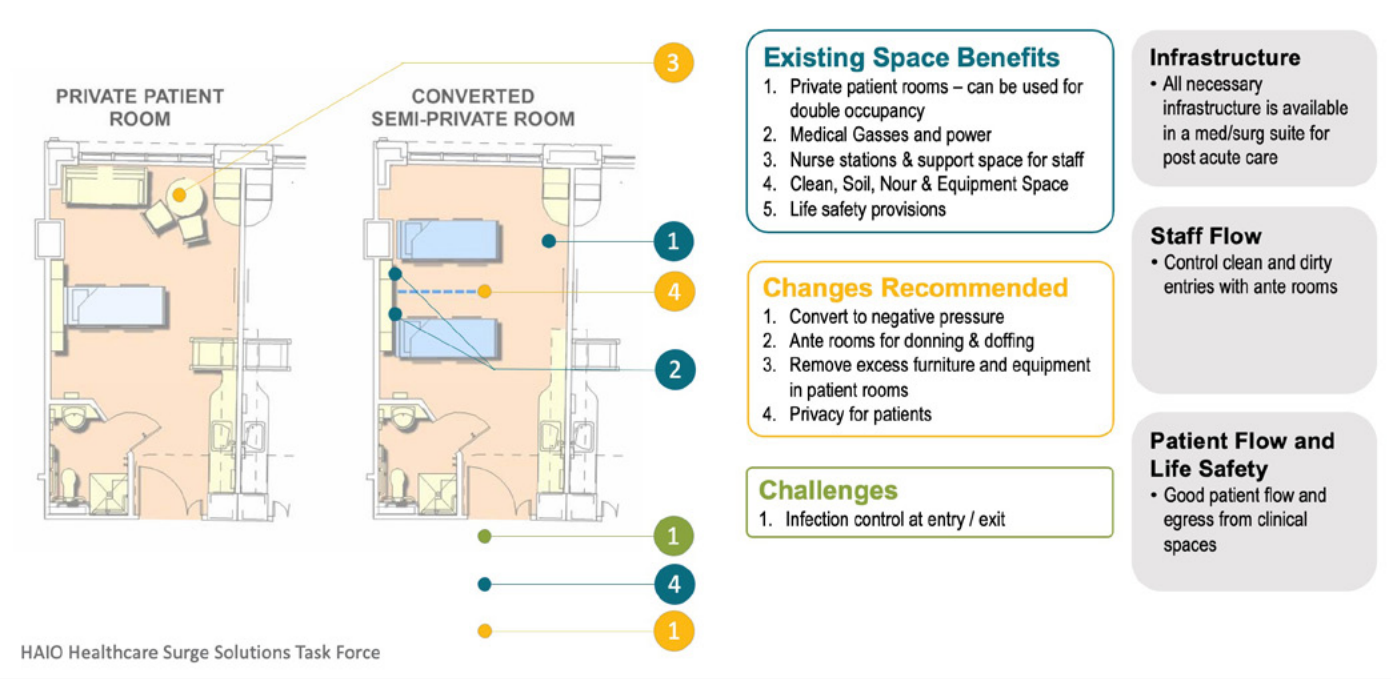
Conversions such as these were more readily accomplished in rooms that had previously been semi-private and had the floor space to provide the required clearances between beds. To be better prepared for future events, some hospitals are considering building new hospitals with slightly larger single-patient rooms that could flex to multiple-patient use during emergency events.

Conversion of medical/surgical beds and PACU spaces

In recent construction projects, some institutions planned for medical/surgical rooms that could be adapted (with minimal construction) to ICUs in the future. During the COVID-19 pandemic, these rooms proved easy to convert for temporary ICU use because they already had the necessary medical gases, electrical power, headwall length, overall room square footage, and air change capacity. With the removal of family furniture (e.g., sofas that are convertible to beds for overnight stay), the rooms fully or nearly met the prescribed clearances for an ICU bed.

The University of Chicago Medical Center's Center for Care and Discovery, completed in 2011, was designed with all universal care rooms. As noted in appendix section A2.4-1.2.1-a (Specific Requirements for Critical Access Hospitals, Size and Layout: Size and layout—Universal care rooms) in the 2018 Hospital *Guidelines*, a universal care room "can vary from ICU to swing bed use. Planning

Figure 2-4: Private Patient Room Conversion Diagram

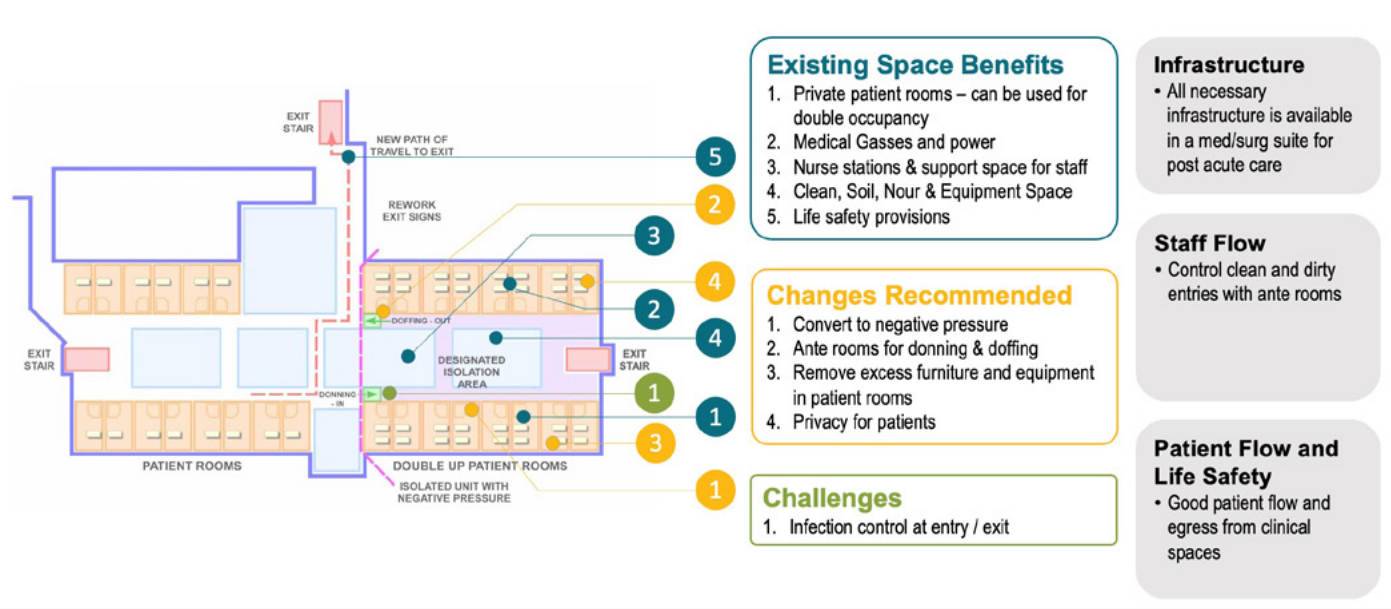


Source: Healthcare Associated Infections Organization

for the highest level of acuity for this room will provide flexibility and use by lower acuity patients would be acceptable."

At UCMC, two floors with universal care rooms were modified to create COVID-19 units, including constructing temporary anterooms at the entrance of the converted patient care units, using existing staff lockers on the floors to provide donning and doffing capabilities, and instituting a one-way flow from the PACU to the COVID-19 unit. As well, because the building had been designed to convert to 100 percent outside air during an infectious disease emergency, this feature was coupled with HVAC adjustments to achieve negative pressure to the corridor for selected rooms. Eventually, it became evident that this conversion would have been simpler had the original building design included anterooms to isolate specific units from one another, facilitating a one-way flow through the designated units.

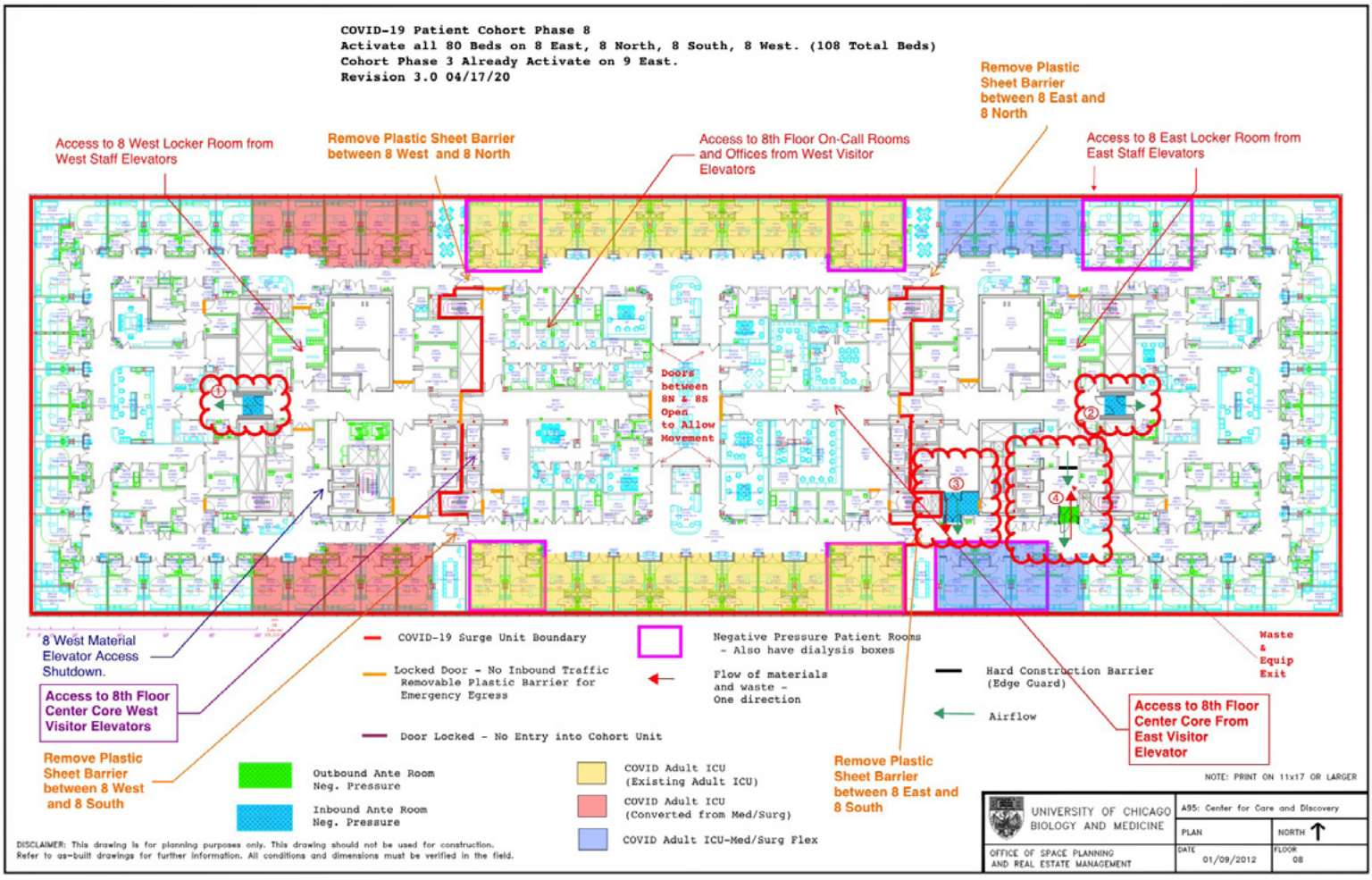
Figure 2-5: Medical/Surgical Unit to ICU Conversion Diagram



Source: Healthcare Associated Infections Organization

Medical/surgical units in older buildings proved more difficult to convert to ICU beds. According to a report produced by Ariadne Labs + MASS Design Group,[6] insufficient space for the increased staff and supply needs generated a sense of disorganization:

Figure 2-6: COVID-19 Patient Cohort Layout



Source: University of Chicago Medicine

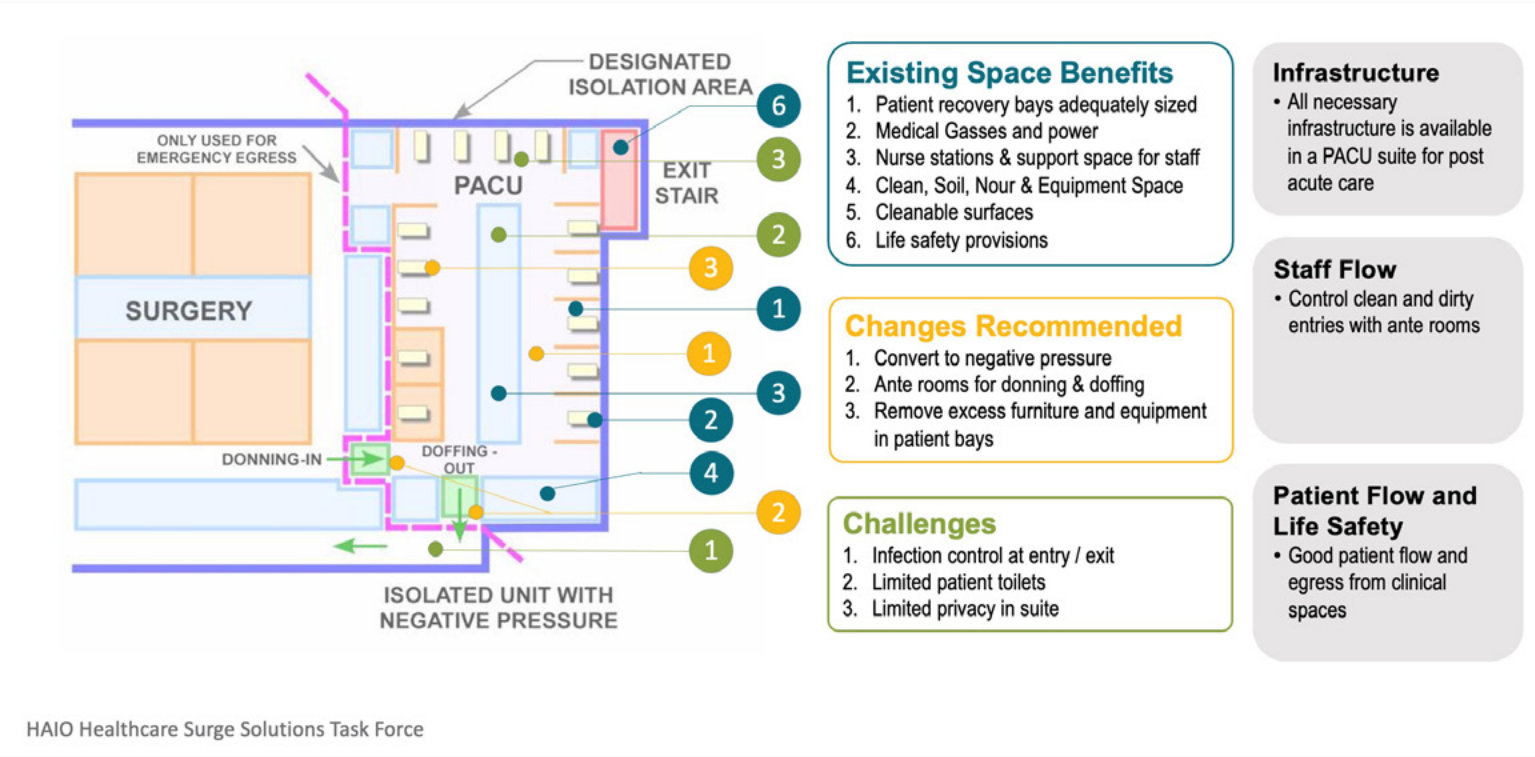
The presence of larger clinical care teams (reflecting lower nurse-to-patient ratios and more ancillary staff), alongside the need to minimize staff exposure within patient rooms, meant that more providers were working in hallways and compromising spatial distancing. In buildings laid out without decentralized nursing stations, individual nurse computer stations were distributed along the hallway. Combined with the addition of PPE carts and recycling bins, as well as more complex cleaning and disposal protocols, the result was hallways crowded with equipment. Particularly in critically ill patient spaces, this left little room for clinician rounding to comply with physical distancing recommendations and introduced inefficiencies that made nurses' work slower.

Conversion of space from PACU to ICU

On March 13, 2020, the American College of Surgeons recommended that hospitals, health systems, and surgeons "minimize, postpone, or cancel elective operations"[7] until the health care infrastructure could support the expected surge in critical patient care needs. The effect of this guidance was a significant nationwide reduction in surgical and procedural volume, which left many facilities, including operating rooms and PACUs, unused. When a critical shortage of ICU space occurred, many health care organizations reported repurposing their PACUs as long-term ICUs.

The following themes and recommendations were identified during interviews as operational problems stemming from lack of space during the COVID-19 pandemic. While the information below is specific to a PACU conversion, these points may be applicable when converting other types of spaces for ICU use.

Figure 2-7: PACU Conversion Diagram



Source: Healthcare Associated Infections Organization

- ***Triage***
  - Patients were triaged to available beds rather than by acuity during surge conditions at some hospitals; this practice led to placement of COVID-19 patients with multiple-organ failure in the PACU instead of the acuity-appropriate ICU.
  - Hemodialysis could not be performed in the PACU at some hospitals due to water supply connector limitations.

  Recommendations. Patient triage decisions should account for severity of illness and any limitations to treating the illness on location (due to constraints with space, equipment, infrastructure, etc.).

- ***Staffing***
  - The nurse-to-patient ratio of a regular PACU is 1:2 to 1:4; an ICU ratio is 1:1 to 1:2.
  - Under emergency conditions that result in patient surges, assigned staff may be unfamiliar with the environment and equipment.

  Recommendations. Staffing levels must be adjusted to account for the severity of illness and should follow the Society of Critical Care Medicine's "Tiered Staffing Strategy for Pandemic."[8] Staff training and visual aids should be employed to reduce potential complications when staff are in unfamiliar environments or using unfamiliar equipment.

- ***Infection prevention***
  - The open design of most current PACUs created a challenge for infection prevention.
  - The lack of defined atmospheres in open spaces challenged the ability of ventilation systems to provide the needed clean-to-dirty airflow.
  - PACUs often have narrow aisles with less space to separate clean and dirty traffic flows, especially when crowded with additional equipment and staff. This led to a higher potential for cross-contamination. The more people allowed in a room, the higher potential for an increased number of infectious particles in the air.

  Recommendations. A PPE station should be established in an anteroom to the PACU, if possible. Employee shifts should be optimized to limit entry/exit from the unit whenever possible. In an open unit, the assumption should be that a level of contamination inherently exists, and patients should be treated in this context.

- ***Supply limitations***
  - ICU supply shortages were common, and ICU supplies are not typically stocked in the PACU so there were problems getting appropriate supplies to the alternate location.

– OR supply rooms should not be solely relied upon for supplies as staff may not have access to this space or knowledge of its layout. In addition, supply levels may not be sufficient to support PACU-to-ICU conversion.

Recommendations. A clinical leader should communicate with purchasing and supply representatives regularly to coordinate the needs of any repurposed PACU.

Table 2-3: Anticipated Challenges and Suggestions for Conversion of a Post-Anesthesia Care Unit (PACU) to an Intensive Care Unit (ICU)

Problem	Challenges	Suggestion for Improvement
Communications breakdown	• New team members • Limited cellular signal	• Implement a shared mental model[9] of success where "individually held knowledge structures that help team members function collaboratively in their environments." • Deploy signal boosters. • Use overhead paging or handheld devices.
Staffing	• Workforce shortages • Mismatched skill sets • Unfamiliar work areas	• Reassign staff. • Employ temporary contractors when necessary. • Create flexible teams with versatile skill sets using the Society of Critical Care Medicine staffing model.[10]
Resource scarcity	• Supply chain limitations • Unfamiliar or limited equipment	• Appoint a clinical leader to coordinate needs with purchasing and supply departments. • Assess supply and equipment levels during each shift. • Train staff on equipment settings and alarms.
Patient monitoring	• Limited patient monitoring ability • Environmental noise pollution	• Use modular monitoring systems, which provide the ability to upscale standard monitoring. • Transfer patients who need less invasive monitoring to PACU-ICU. • Use diligence when setting alarm thresholds for monitors, ventilators, and infusion pumps.

Table 2-3: Anticipated Challenges and Suggestions for Conversion of a Post-Anesthesia Care Unit (PACU) to an Intensive Care Unit (ICU) *(continued)*

Problem	Challenges	Suggestion for Improvement
Infection prevention	• High risk of cross-contamination • High risk of health care worker exposure	• Work closely with infection prevention staff on implementation of isolation protocols based on the most current CDC recommendations. • Ensure staff are adequately trained in donning and doffing the specific PPE that is provided to reduce their risk of exposure. • Use visual aids (e.g., signage and "ball in the wall" pressure monitors) to identify patients in isolation. • Post checklists for PPE donning and doffing procedures. • Provide anterooms to support infection prevention practices and space for PPE donning and doffing. • Avoid bronchoscopy and non-emergent endotracheal tube exchange or intubation. • Ensure the suction circuit is intact before performing pulmonary hygiene. • Limit noninvasive procedures in positively pressurized open areas.
Patient positioning	• Shortage of ICU beds • Need for patient proning	• Reserve full-size beds for patients at high risk of positioning injury (e.g., morbid obesity, preexisting pressure ulcers). • Use a dedicated prone positioning team and checklist.
Acute respiratory failure	• Limited supply of ICU ventilators • Use of ventilators with limited modes and diagnostic feedback	• Use critical care-trained physicians to manage mechanical ventilation. • Reserve traditional ICU ventilators for patients at the highest risk of mortality.
Acute renal failure	• Limited supply of hemodialysis machines • Inability to perform hemodialysis in PACU due to space or med/gas and outlet limitations	• Triage patients at risk of requiring hemodialysis to regular ICU. • Consider use of continuous renal replacement therapy or peritoneal dialysis.
Barriers to transfer/ discharge	• Limited bed availability in the main hospital • Need for prolonged artificial airway	• Involve social workers (via teleconference, if necessary) to assist with discharge planning. • Consider percutaneous tracheostomy using ultrasound-guided bronchoscopy.

Adapted with permission from M. James Lozada, D. W. Gray, et al., Vanderbilt University Medical Center, Nashville

Managing patient entry through the ED

In most emergency conditions, people requiring care will arrive through the ED's primary entrance. Hospitals are often overwhelmed by the number of patients arriving in an emergency, and it can be challenging to triage patients and move them to appropriate treatment spaces, especially while simultaneously maintaining care for typical ED patients. Where infectious or hazardous materials may expose other patients, visitors, and staff to harm, it will be essential to create separate paths of travel for typical ED patients and patients who present due to the emergency event.

Some Chinese hospitals routinely sort infectious patients who present at the ED—and not just during epidemics or pandemics—and send them to the designated "fever clinics" offered at many hospitals in China.[11] Although not consistently required by local building codes, where built these clinics have a dedicated entrance to screen patients with suspected fever-causing viruses like influenza and COVID-19. This alternate triage path diverts potentially infectious patients from areas where they would mingle with the non-infectious ED population. In Shanghai, patients with infectious diagnoses are transferred from fever clinics to specialty infectious disease hospitals. This strategy may protect patients, staff, and visitors; however, it is not widely practiced in the United States, where there are no dedicated infectious disease hospitals.

The recommended strategy for preventing the spread of respiratory infections in the United States is the routine practice of what is known as respiratory hygiene/cough etiquette.[12] These are practices intended to prevent transmission of all respiratory infections in health care settings. They include use of signage alerting patients to report if they have a fever or cough in addition to the provision of tissues, masks, and hand hygiene supplies to enable those with a cough or fever to contain their secretions. The COVID-19 pandemic has served to highlight the importance of these routine practices, which should be in place at all hospital and clinic entrances, including the ED.

Other Considerations Affecting Patient Care During Surge Events

Interviews conducted by the surge capacity subcommittee yielded the following additional considerations to improve patient isolation and limit staff contact.

Location of Biomedical Equipment

To reduce the number of times caregivers entered a patient's room, designated COVID-19 units requested additional power strips and tubing so IV pumps and vital sign monitors could be pulled out of the patient's room for distanced monitoring. This additional wiring and tubing led to difficulty in closing doors tightly. Some caregivers suggested it might be helpful to supply ports (similar to an MRI waveguide) in the wall between the patient room and corridor for use during infectious disease emergency events. Cords and tubing could be threaded through these ports to keep biomedical equipment outside of patient rooms and prevent issues with door movement or maintenance of room pressurization.

Clearly Posted Isolation Precautions

Providers should be able to see listed isolation precautions clearly, including PPE donning and doffing sequences, before entering or leaving a room. In many cases during the pandemic, this information receded into all the other visual clutter. One means of remedying this problem would be linking digital signage to medical records so the isolation precautions for individual patients is accurate at all times. This could be cost-prohibitive so benefits and costs would have to be assessed.

Windows in Patient Room Doors

At some facilities where medical/surgical rooms were used for ICU-level patients during the COVID-19 pandemic, the doors to

these patient rooms were retrofitted with 2 × 2 plexiglass windows. When planning for future emergency conditions, health care organizations should consider designating overflow surge spaces and incorporating windows in the doors of these units as a basis of design.

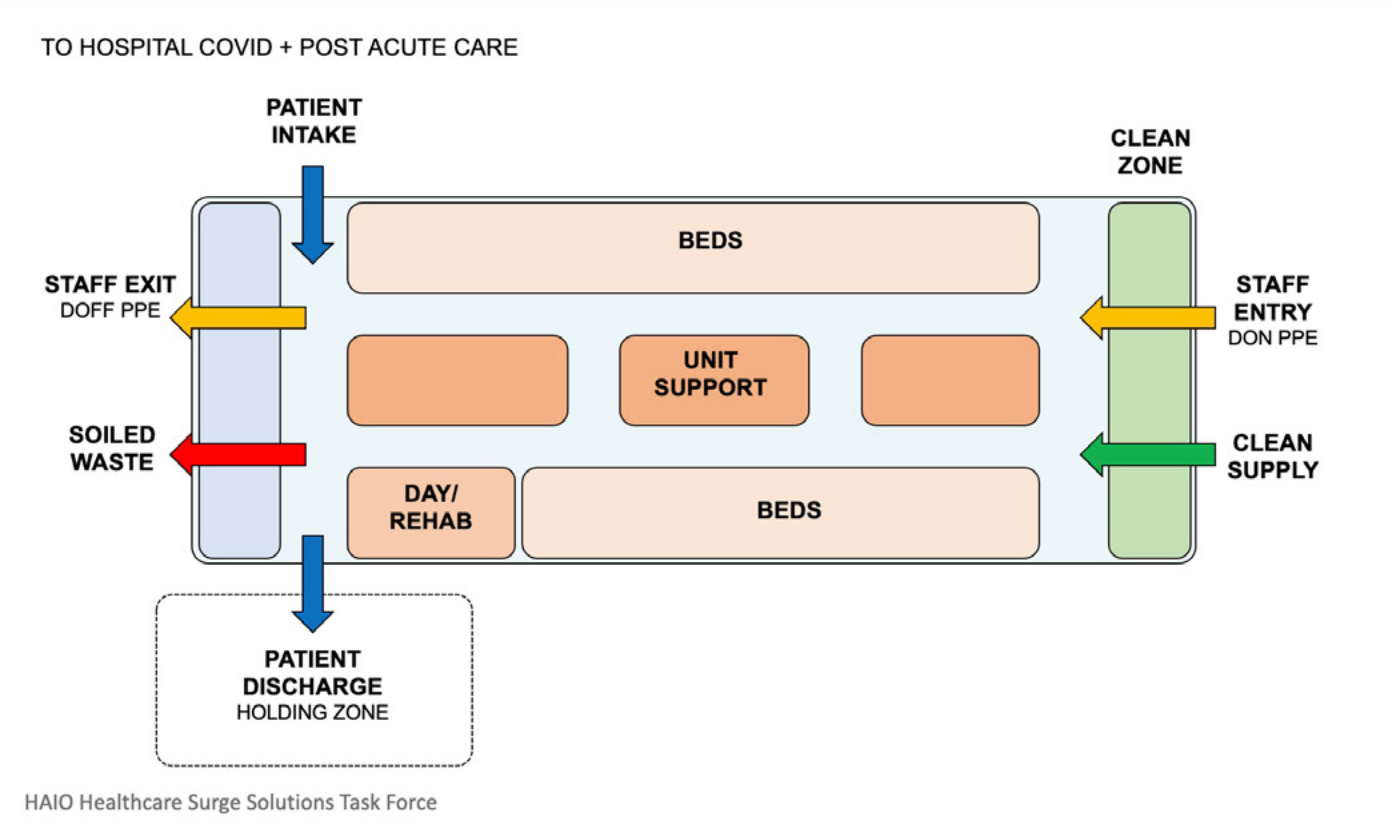
Infection Prevention Factors for Design and Operations

Clinicians are aware of safety and infection risks in normal hospital settings. Under the conditions of a pandemic, when patient units are reassigned for different purposes, personnel may be deployed to unfamiliar units. When a disease is new or unknown, it is difficult for hospital staff to assess their risk and follow appropriate protocols in unfamiliar spaces. Ariadne Labs + MASS Design Group studied this phenomenon at Mount Sinai Hospital in New York City during the peak of the COVID-19 pandemic. They concluded that "thoughtful spatial interventions can help create situational awareness for COVID-19 units, set clear and consistent protocols for thresholds, align appropriate behavior within well demarcated risk zones, and identify opportunities to more safely and flexibly expand capacity during surge conditions."[13]

At some facilities, the COVID-19 pandemic highlighted conflicts between interior space designs intended to be warm, comfortable, and home- or hotel-like and designs geared toward infection prevention, which focus more on surface cleanability and durability. Some staff expressed concerns regarding soft seating, carpeting, and general clutter that visitors bring with them. Clutter can also result from staff not having sufficient locker space. Half-height lockers do not accommodate coats, boots, bike helmets, or backpacks.

Staff are generally restricted from eating or drinking at their documentation stations for basic infection prevention reasons; however, there is often insufficient space in the unit lounge for them to eat or drink. This was especially problematic during the COVID-19 pandemic, when staff had to maintain physical distancing while eating or drinking.

Figure 2-8: Operational Flows Diagram



Source: Healthcare Associated Infections Organization

Table 2-4: Other Challenges and Solutions for Patient Care Areas

Challenge	Solution
Room headwalls were not designed with wiring to support a ventilator at the bedside. Consequently, there was no way to monitor the ventilator alarm remotely.	A staff "sitter" was stationed outside the room to listen for alarms from the ventilator and alert a caregiver when they went off.
To reduce exposure to COVID-19 patients and preserve scarce PPE, a limited number of clinical team members entered a patient room for rounds or bedside care while the rest of the team remained in the corridor. There was no means to communicate between teams.	The unit staff relied on iPads to communicate between clinicians in the room and those in the corridor.
Staff were unable to visually monitor patients through solid doors and walls; lack of visibility meant staff had to physically enter the patient room.	Several hospitals modified the doors to patient rooms to provide visibility when the room was used for critical care patients.
Open patient care areas created opportunities for disease transmission.	Temporary walls and doors were erected to enclose patients in hospital ICUs with open, three-sided bays.
Guidelines and protocols from the CDC and other sources on appropriate behavior, PPE, and management of patients changed frequently during the COVID-19 pandemic. Hospitals struggled to post paper notices with the latest guidelines and to assure that outdated notices were removed.	Staff suggested that digital signage would have been helpful during this period because it is easy to update and provides visual clarity.

Dialysis Considerations

Hospitals reported that a co-morbidity of COVID-19 affected the kidneys and increased the need for dialysis. Some interviewees noted that the lack of dialysis capability in units where infectious patients were being treated required taking the patients to another part of the hospital, which put others at risk of infection. A consideration for new FGI *Guidelines* may be requiring/recommending installation of dialysis boxes in a certain number of ICU rooms and/or airborne infection isolation rooms. Other reported problems stemming from the COVID-19 dialysis co-morbidity include:

- One hospital reported that as the need for bedside dialysis for ICU patients increased, the treatments had to be cut short to accommodate the 1:1 registered nurse (RN) staffing required for dialysis.
- Nurses typically stay in the room while a patient receives bedside dialysis so they can quickly respond to issues with

discontinuation of treatment or machine alarms. RNs during the pandemic were required to wear full PPE and stay in the room for three to four hours during dialysis. Nurses reported that the resulting heat and inability to hydrate were overwhelming. In some cases, sitters were provided to relieve bedside dialysis nurses for bathroom and hydration breaks.

- Staff struggled to find a way to monitor patients on dialysis from outside the room. One health care organization considered using a baby monitor with camera but ultimately rejected the idea due to potential Health Insurance Portability and Accountability Act privacy violations. Technology that allows staff to remotely monitor a patient receiving dialysis treatment (i.e., without having to stay in the room for the entire length of treatment with full PPE) should be explored.

Support for Families and Other Visitors

The physical environment can provide some supports for those wanting to see or learn about friends and family members who are patients during an emergency event.

Communication Between Patients and Families

During infectious disease emergency events, the risk of virus transmission and possible lack of PPE may prevent family members from visiting patients. During the COVID-19 pandemic, this situation was isolating, stressful, and demoralizing for patients, families, and clinical staff who gave care and comfort to patients. Overwhelmed staff had only technology-based solutions to connect families with patients and struggled to manage non-clinical issues such as locating appropriate and sufficient phone and tablet chargers, learning how to use various devices and conferencing platforms, and finding enough digital tablets or other devices to allow patients to communicate with their loved ones, sometimes for the last time. Organizations should consider increasing their supply of digital communication devices and assure that staff are familiar with how to use them, including how to sanitize these devices between uses.

In addition, bandwidth capacity will need to be evaluated to assure connectivity is possible when most needed.

Family Waiting Spaces

During an emergency event, space will be needed for friends and families to gather and wait for information. The space should be located away from the emergency room and discreet enough to avoid media attention. In addition, the space should have:

- Clear wayfinding signage and cues
- Charging stations for patient, visitor, and staff phones and devices
- Access to toilet rooms
- Access to water and snacks
- Seating, with enough space to allow for physical distancing during an infectious disease event
- Dedicated staff assigned to the waiting space

One health care organization created a family resource center across the street from the ED to offer families a place away from the chaos and to control media access to them. If resources allow, organizations should consider providing digital tablets to enable and encourage communication with isolated patients.

Clinical Support Services

Traditional clinical support services include laboratories and pharmacies and food, supply, and storage services; these support services provide critical assistance to inpatient and outpatient care teams. Keeping the general supply chain safe and managing materials as well as distribution and dispensation functions during an emergency is dependent on the following factors:

- Internal and external supply chains
- Security of support areas

- Proximity of support areas to patients
- Location of support service areas in the facility
- Staffing for these services
- Regulation by numerous agencies (e.g., state department of health, U.S. Food and Drug Administration, Centers for Medicare & Medicaid Services)

Laboratory Concerns

When a hospital-based lab is at or near capacity, collection and/or specimen processing is usually handled by an outside commercial laboratory. The ability of this lab to process hospital specimens in a timely manner may be affected by demand from other health care facilities as well as the lab's regular processing volume.

To plan for a surge event, laboratory managers recommend identifying and executing a standing operating agreement or memorandum of understanding with one or more commercial labs likely to be available during an emergency. In addition, the health care organization should consider developing an "essential testing policy" to set priorities for testing services during various emergency scenarios. The organization's emergency operations plan should outline the stages, procedures, and protocols necessary to keep lab services functioning efficiently during a surge event.

Some health care organizations also designate alternate specimen collection sites in a facility or system for use during surge events. Staff supporting these sites must be qualified in laboratory services, and special care must be taken to maintain source accuracy when labeling and transporting specimens from an alternate collection site.

Pharmacy Concerns

Pharmacy department leaders regularly monitor their own organization's periodic automatic replacement (PAR) levels and national supply levels through various websites (e.g., U.S. Food and Drug Administration[14]). However, several factors discussed in this section can lead to issues with supply chain management and the adequacy of pharmacy storage.

Supply chains and the need for increased storage space

In recent years, many drug manufacturers have exited the market, creating concern among pharmacy leaders about a "just-in-time" approach to stocking pharmacological supplies. As a result, pharmacy on-site storage needs have grown to accommodate higher PAR levels, leading to increased demand for both centralized and distributed storage space.

Another factor contributing to the need for additional storage is stockpiling of key ingredients to compensate for limited sources. For example, while exact numbers are unknown, it is believed that about 80 percent of the basic components used in U.S. drugs come from just two sources—China and India.[15] Public news media can sometimes induce periods of panic-buying due to shortages of over-the-counter drugs (e.g., Tylenol); when this happens a hospital's ability to acquire these medications is inhibited.

The Centers for Disease Control and Prevention (CDC) manages the national stockpile of key medical supplies, including pharmaceuticals that may be dispensed during specific emergencies. These are held at various hospitals across the United States that function as local referral centers. While the CDC controls the overall supply, local authorities may utilize these resources when a municipal incident command center contacts the CDC. For more information, see the CDC Office of Public Health Preparedness and Response fact sheet on the Division of Strategic National Stockpile.[16] When a state of emergency is declared, controls on availability of supplies are loosened.

Beyond pharmaceutical supplies, pharmacists require typical PPE for maintaining pharmaceutical preparation standards (e.g., compounding, preparation of intravenous fluids). Health care providers have historically shunned reuse of such equipment. Therefore, assuring availability of these supplies is an important emergency measure.

When supply chains are strained, hospitals may also struggle to obtain cleaning agents (e.g., sterile alcohols, bleach) to properly clean and sanitize equipment and spaces as required by infection prevention protocols. Providing enough storage space to hold an ample supply of these materials is crucial to the continuance of operations during emergency conditions.

Security

Following a 2006 incident at a hospital where a pharmacist was shot and killed,[17] all public-facing portals at the Florida facility were secured with bulletproof glass. As well, all access portals became digitally controlled and equipped with successive layers of access, ranging from semi-public to pharmacist-only. Such design approaches would be appropriate in a facility facing an emergency event.

Proximity to patients

Clinical operations typically require pharmacological supplies to be stored near patients for immediate use. During the COVID-19 pandemic, some pharmacists expressed concern about possible exposure to infectious patients. Although pharmaceuticals may be dispensed from a machine in a unit, that is not always the case, especially during a temporary but long-duration surge condition. Means of protecting the health of pharmacists who interact with patients during emergency conditions should be planned in advance, including provision of appropriate PPE and training in infection prevention protocols for donning and doffing PPE when working in close proximity to patients.

Sometimes, access to sections of patient care units may be restricted due to infection prevention protocols. This scenario requires medications to be accessible for patients in both the restricted and unrestricted areas of the unit, suggesting provision of multiple medication rooms is worth considering during project planning.

General pharmacy location

Main hospital pharmacies are typically located on the lower levels of hospitals, often in the basement or below grade, especially in older facilities. These locations can be prone to rodent infestation, flooding, and hydraulic (ground-based) water sources and may be at high risk for mold and mildew, even with adequate ventilation. A hospital pharmacy may have 3,000 medications on hand at any one time, the loss of which could be disastrous. Typically, no alternative "high-ground" locations for that much storage are available on a temporary basis during an emergency event.

The U.S. Pharmacopeial Convention (USP) addresses pharmacy placement in USP-NF General Chapter <797> "Pharmaceutical Compounding—Sterile Preparations[18]" and USP-NF General Chapter <800> "Hazardous Drugs—Handling in Healthcare Settings."[19] These documents encourage locating pharmaceutical resources away from below-grade and other incident-prone areas (e.g., loading docks where diesel exhaust can infiltrate airspace). Pharmacy location is an ongoing issue among facility managers and designers because of the capital costs, emergency power requirements, and dedicated air-handling and exhaust requirements for the sterile compounding clean room functions of the pharmacy.

At facilities with below-grade pharmacies, finding a temporary location for pharmaceutical supplies may be difficult. One solution during surge events could be use of mobile/transportable medical units or modular structures. This solution could address storage, compounding, and retail needs, but requires power and water connections and appropriate levels of security.

Food Service Concerns

Surge events can strain food services in a hospital or long-term care facility in various ways. Some emergency events (e.g., weather-related events, pandemics) may require staff to remain on the premises, requiring all food to be provided on campus. Depending on the nature of the emergency, there may be breakdowns in the supply chain, limiting the availability of some supplies and hindering regular deliveries. In an epidemic or pandemic event that places staff and patients at risk of exposure to an infectious disease, workflows between kitchens and retail outlets may need to be changed as well as the ways in which meals are delivered and supplies are used. Procedures for managing food services during different emergency scenarios should be outlined in the health care organization's emergency operations plan.

Surge storage for non-perishable food supplies

Non-perishable food service supplies such as paper goods may serve a variety of useful purposes during surge events or other emergency situations. For example, during the COVID-19 pandemic, patients in many hospitals were served meals on paper goods to reduce handling and the number of times staff needed to enter a patient's room. To support this use, designated storage should be provided for disposable paper goods intended for emergency events. These supplies should be stored in an area that is unlikely to be damaged or compromised during such an event.

Food and water sufficiency

Where food services are provided, provisions should be made to assure food service operations will continue until patients can be transferred to another facility or normal operations are restored. In some cases, this could require days of sustained food service operations. Above-grade storage space should be provided to hold sufficient amounts of food and water to support the entire patient, visitor, and staff population for 96 hours.

A proposed new FGI *Guidelines* requirement for emergency food storage is similar to the requirement for generator fuel storage for short-term needs in Section 2.1-8.3.3.1 (2) (Power-Generating and -Storing Equipment—Essential electrical system) of the 2018 Hospital *Guidelines*. These emergency support systems should be coordinated.

Support for increased hand-washing

As food preparation volume increases, so does the need for additional hand-washing among preparation staff. The requirements for hand-washing stations in food preparation and serving areas in the 2018 Hospital *Guidelines* allow for location of a sink 20 feet from the farthest end of what could be a large food preparation area. Hand-washing stations in food preparation and serving areas should be located so staff have closer access to a sink to facilitate hand-washing.

Alternate uses for secondary food service areas

During emergency conditions, secondary food service areas (e.g., dining areas) may be repurposed to support clinical services. Planning for the types of functions (e.g., emergency care, inpatient care) to be provided in such spaces could enable their easy, temporary transformation. Features and services required for such alternate care arrangements should be considered during planning; these include provisions for medical gases, nurse call, power, privacy, and HVAC controls (e.g., temperature, pressure relationship, air changes). If a dining area is commandeered for alternate uses, plans should be in place for the continuation of food services elsewhere.

For dining areas to be easily converted for an alternate use site, all seating and tables should be movable. Physical separation parameters can be employed, such as those for physical distancing implemented during the COVID-19 pandemic. Various spacing scenarios should be considered.

Essential equipment on uninterrupted power

Hospitals may lose power for long durations amid emergency conditions. During this time, food deliveries may be impossible. Thus, it is essential that hospitals have the ability to preserve food on-site to maintain care for staff and patients. The amount of time refrigeration equipment will need to be on an uninterrupted power source to achieve this should be determined during project planning so appropriate infrastructure is provided.

Other Support Service Considerations

Other support services likely to be directly affected by emergency conditions are discussed here.

Supply Chain Management

During an emergency event, any disruptions to the supply chain—particularly a national or international disruption—can be disastrous for a health care organization's response to the event. To prepare for this situation, health care organizations should consider how to manage the increased need for supplies during a surge in demand for their services.

Personal protective equipment

The shortage of supplies, particularly PPE, reported during the COVID-19 pandemic underscored the shortfall of just-in-time supply deliveries to health care facilities.

PPE storage and supply. The shortage of PPE during the pandemic highlighted the necessity of planning in advance for supply movement and storage during a large-scale and/or widespread emergency condition. An organization may have time to bring supplies stored off-site to the facility for an anticipated emergency event, but additional on-site storage for PPE is advisable to assure the organization is prepared for unanticipated events.

Decontamination and reprocessing of PPE. During a surge event, modular units may be required to serve as decontamination and reprocessing facilities for PPE supplies such as N95 masks. To facilitate reuse of N95 masks during the COVID-19 pandemic, some organizations set up a decontamination chamber in mobile/transportable medical units while others contracted with outside vendors. Contracting this service to outside vendors was found to be a more efficient and better-controlled process.

Similar to on-site sterile processing facilities, separate workflows are required for soiled PPE coming in for processing and clean PPE going out for distribution. Space for donning/doffing and facilities for hand-washing are also needed. When organizations plan to decontaminate PPE on-site, space will be required for prepping and sorting items to be decontaminated and sorting and distributing clean items after processing. The organization's EOP should identify existing areas that may be repurposed during emergency conditions and include operational and physical requirements to support the change in use.

Linen services

A need for clean linens and an accumulation of soiled linens are typical during an emergency condition; thus, additional space is required to store these items. During the COVID-19 pandemic, some organizations mandated that all staff wear scrubs during shifts, regardless of position. This resulted in many more scrubs needing to be laundered and stored than usual. Here again, temporary and/or modular units could be used to accommodate additional demand for linen services.

Numerous organizations increased their off-site storage capacity in this manner during the COVID-19 pandemic, and many intend to maintain this surplus storage space for the foreseeable future. As with all stockpiles, supply storage should be carefully managed and monitored to assure inventory is rotated and to prevent the use of expired or otherwise compromised products.

Waste Management

The need for separate flows for clean and soiled materials in and out of health care facilities is magnified during an emergency event. When designing a facility, these workflows should be carefully considered to avoid cross-contamination, not only for typical flows but for potential surge events as well. Safe methods for disposal should be identified during emergency planning, along with provisions for a sustainable waste management plan that addresses logistics for the increased frequency of pickup for medical waste, general waste, and recyclables during high-volume events. A loading dock or receiving area with adequate staging and storage space for a typical day can quickly become overwhelmed by an influx of supplies or delay in waste removal. Thoughtful waste management planning can mitigate these issues with little or no additional square footage required.

Space for Managing Donations

During certain emergency events, a surge in community donations may require allocation of staff and space to receive and process donated items. One urban safety net hospital reported a significant increase in donations of blood and PPE after a mass casualty event and during the COVID-19 pandemic. PPE donations had to be sorted and stored until they could be distributed. Blood donors needed additional waiting space. Means to support public donations should be included in an organization's DEVA or EOP.

Building Systems

Under normal conditions, the systems that provide hospitals with power, lighting, heating, cooling, ventilation, and environmental controls should run quietly in the background and support the care and healing of patients. These infrastructure systems are typically out of view of patients, staff, and visitors, yet they are vitally important to assure the building and equipment function safely at all times. Most requirements for these systems fall under the purview of other codes (e.g., ANSI/ASHRAE/ASHE 170: *Ventilation of Health*

Care Facilities, NFPA 101: *Life Safety Code*, NFPA 99: *Health Care Facilities Code*, IES-RP 29: *Lighting for Hospitals and Healthcare Facilities*). Considerations relating to building systems that should be coordinated with these other codes are discussed in this section.

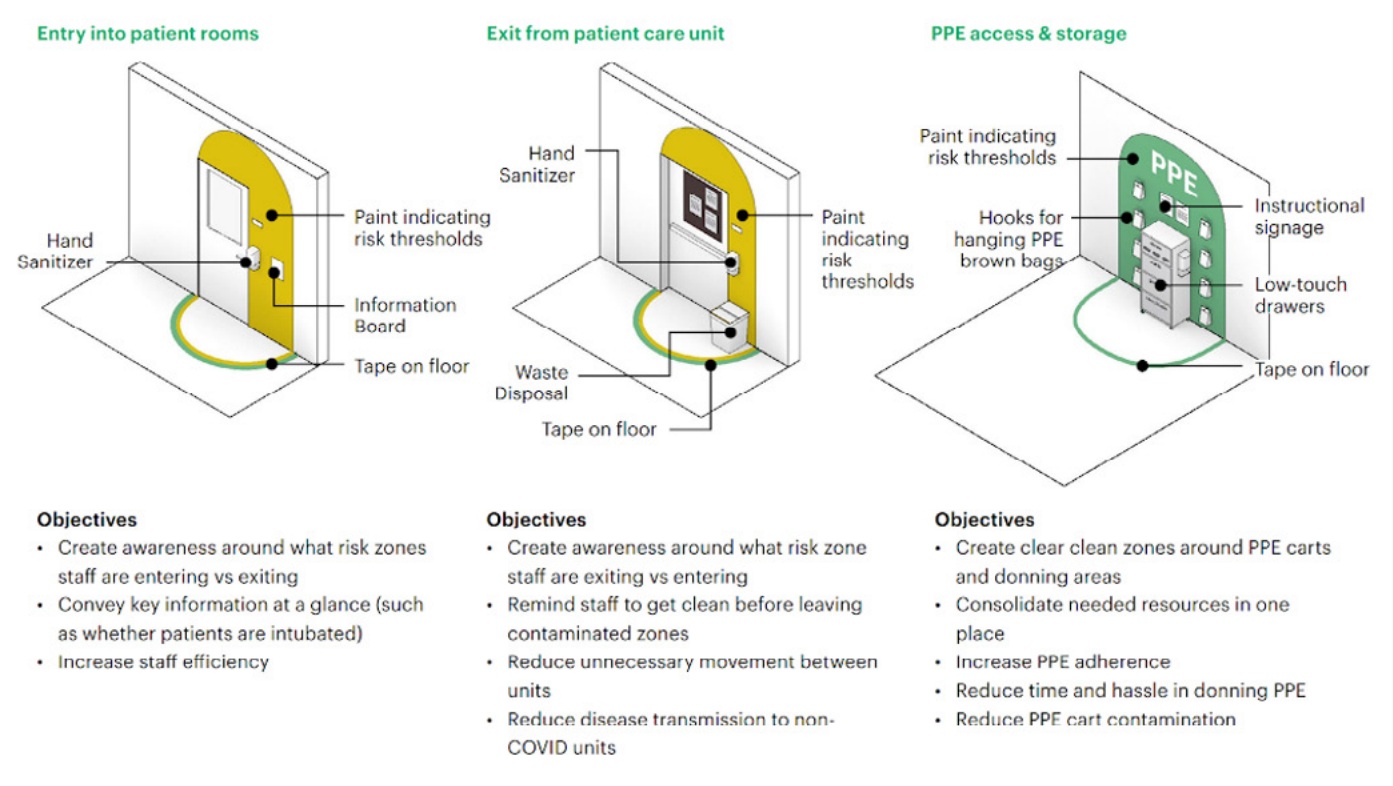
Lighting Systems and Wayfinding

When patients surge into new areas of a health care facility, support staff will be required to quickly assess the risks from entering these locations. To alert staff to these changes in use, clear visual cues should be provided for those entering and exiting areas that pose a high risk of exposure to infection or contamination (the heat map in Table 1-1 can be a useful tool for identifying risk levels). Organizations should develop interior and exterior signage and other visual cues (e.g., signs for "contaminated" and "clean" areas) that have consistent colors and symbols, regardless of location; this practice will make the signs more effective.

New light-emitting diode (LED) lighting products provide opportunities for patient wayfinding support during an emergency event. For example, color-changing LED lighting that corresponds to the standard colors of patient triage (i.e., green for walking wounded, yellow for those who are currently stable but need care, and red for those who need immediate care) can be incorporated into the ceiling or floor. These lights can then be activated when an emergency condition arises to immediately define pathways for staff, patients, and visitors.

In existing facilities where LED lighting for directional purposes cannot easily be added, graphics may be used to communicate risk to caregivers and staff throughout the hospital. An example of this approach is described in "The Role of Architecture in Fighting COVID-19: Redesigning Hospital Spaces on the Fly to Protect Healthcare Workers,"[20] which documented the work of a team of designers, researchers, and clinicians from Mount Sinai Hospital in New York City as they prepared to address infrastructure modifications during the COVID-19 pandemic.

Figure 2-9: Sample Risk-Based Signage and Visual Cues



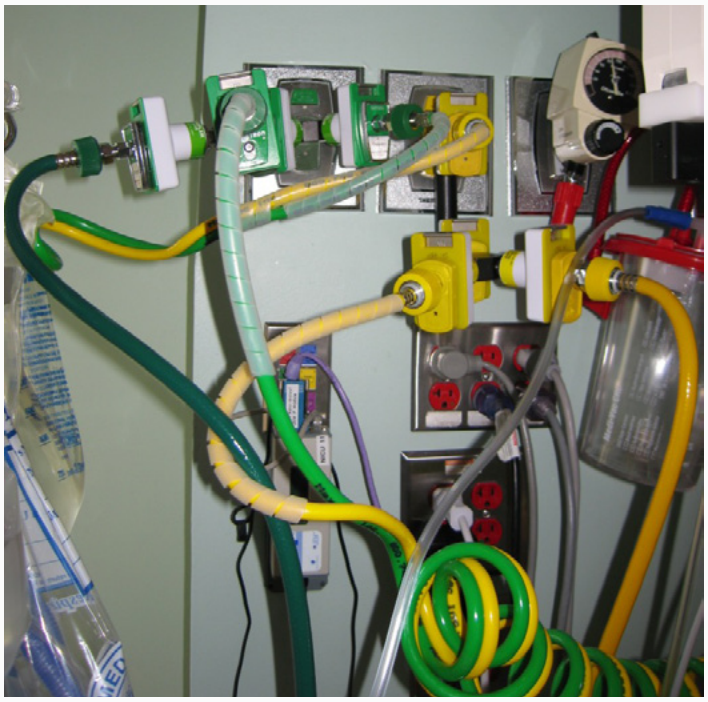
Source: Ariadne Labs + MASS Design Group

Medical Gas Systems

Medical gas system capacity often must be increased during a patient surge. Although traditional methods for doing so have limitations, two approaches are commonly employed to expand medical gas services during patient surge events.

The most frequently used approach is installation of temporary fittings to medical gas wall outlets, extending the total number of outlets available. Standard "Y" fittings can effectively increase (i.e., double or more) the number of these outlets. However, this modification can cause permanent damage to the in-wall outlets because extending the outlet beyond the wall creates a lever and increases the weight on the outlets. An alternate method is to provide longer hoses and extensions to further separate outlets. Both of these methods should be used with caution, as additional outlet pipe distance and use rate may adversely affect the flow rate of the medical gas system.

Figure 2-10: A Highly Compromised Bedside with Splitters Mounted on Splitters



In this example, infrastructure has not kept pace with clinical need and a dangerous clinical space has been created.

Source: Paladin Healthcare, LLC

A second approach is to increase the number of high-pressure medical gas cylinders in use in the facility. These devices are portable and can provide gas directly to the patient; this flexibility allows for an immediate increase of capacity. However, single-cylinder systems do not provide the same level of redundancy that a piped medical gas system provides: one fault in a cylinder or connection may result in immediate loss of gas, which could lead to patient injury.

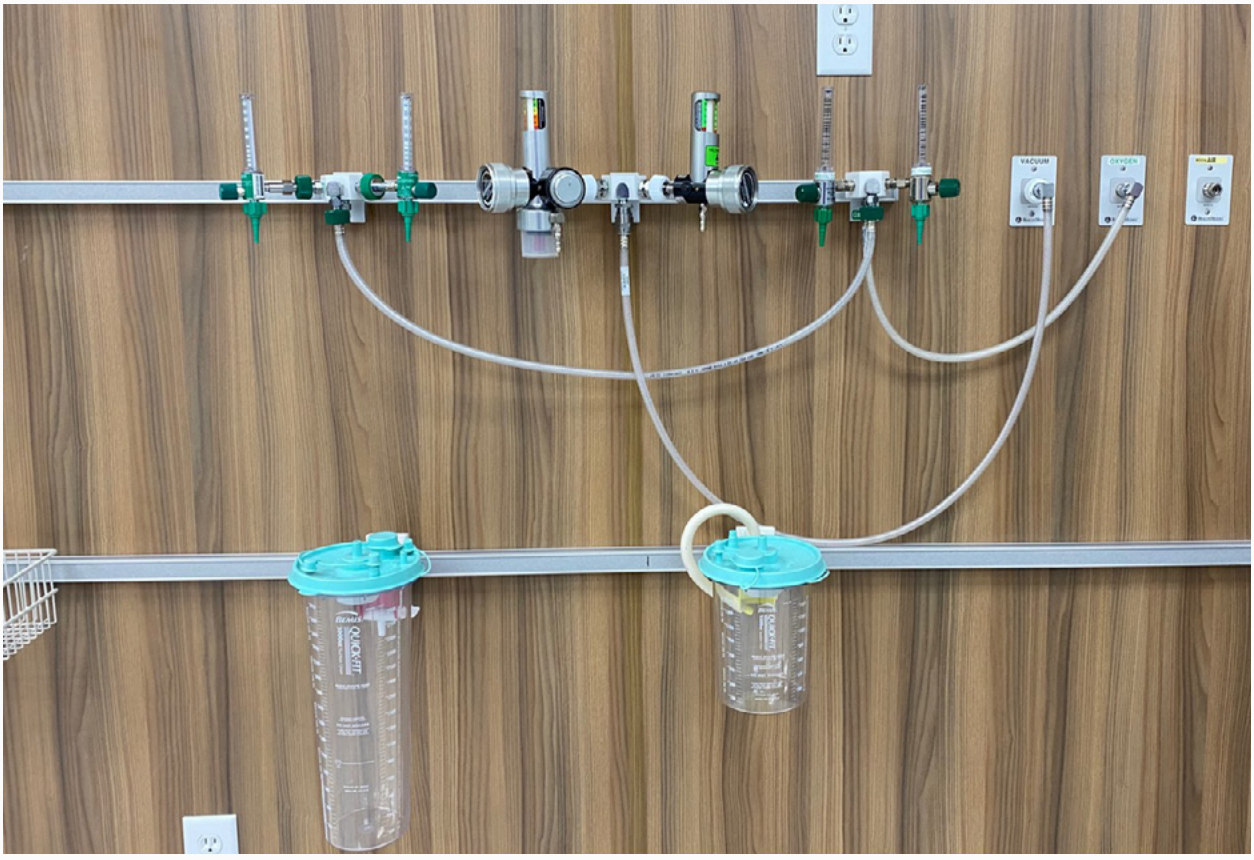
The total amount of oxidizing gas (both oxygen and nitrous oxide) in an area is typically limited by established fire codes. Such risks can be mitigated by better observation of patients and cylinders and by increasing fire watches in the space. Of greater concern are limitations in the supply chain; for example, during the COVID-19 pandemic, some health care organizations found there were not enough cylinders to support the thousands of alternate care site beds that were built to accommodate the patient surge.

The health care community could benefit from a forward-looking assessment of new technology or ways of deploying traditional medical gas systems. This would allow users to safely add medical gas outlets on demand, without compromising safety or existing infrastructure. FGI's surge capacity subcommittee suggests that industry leaders consider new design standards that implement new or existing technologies to mitigate these challenges. Recommendations to support expansion of medical gas capacity include these:

1. Provide every patient room with an equipment rail system to the left and right side of the headwall. This is a very common and reliable solution that allows for rapid expansion using rail-mounted accessories. Initial costs are minimal, lifecycle cost savings are significant, and deployment is immediate.

2. Consider the use of oxygen concentration systems that mechanically produce concentrated oxygen gas at lower pressures, often with sufficient flow rates for patient care. These systems can be individual units, such as those seen in home care scenarios, or large, multiple-use supply systems, such as those seen in military field hospitals. Fire risks tend to be lower with individual units than with high-volume systems, which often exceed the maximum allowable quantity limitations found in fire codes. Current built environment codes and standards do not address the use of these types of systems in health care environments. These standards could identify and quantify the risks of these systems and identify proper mitigations for temporary use.

Figure 2-11: Medical Gas Expansion Rail

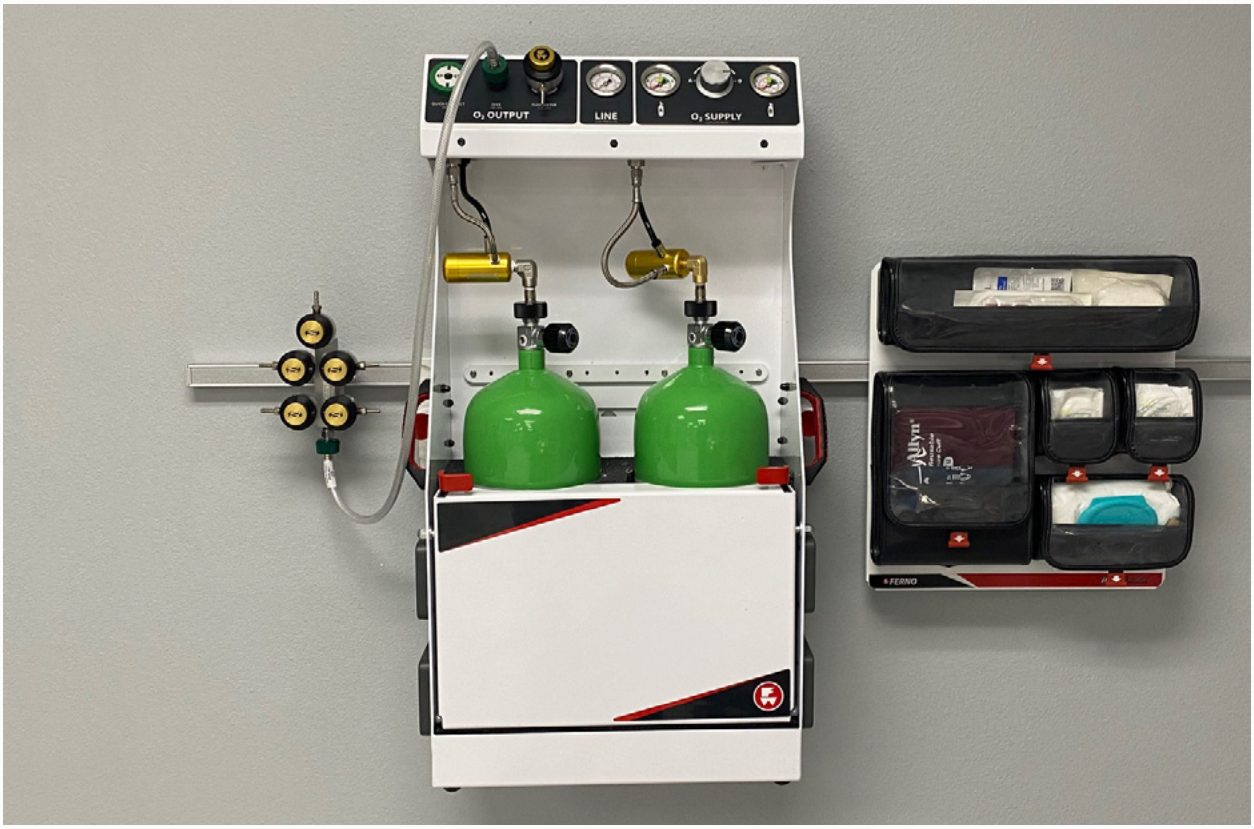


Integration by design of an equipment management rail allows for safe and clinically appropriate on-demand gas expansion.

Source: Paladin Healthcare, LLC

3. Recent advances in oxygen delivery technology include a lightweight carbon fiber tank integrated with a portable manifold system, which delivers high-capacity oxygen in a portable package. The device may be wall-hung on a rail system or integrated into a mobile cart.
4. Another solution, noted from an interview during the COVID-19 pandemic, is to add permanent headwalls into non-traditional care areas such as waiting rooms. This, along with option 1 described above, would require increased capacity to the overall gas delivery system, including storage capacity, evaporators, and piping systems.

Figure 2-12: Carbon Fiber Medical Gas Tank



Portable and lightweight tanks can provide on-demand high-capacity oxygen where patient care is provided (e.g., hotels, gymnasiums, surge areas in hospitals).

Source: Paladin Healthcare, LLC

Figure 2-13: Portable, High-Capacity Gas Delivery Combined with an Equipment Rail Outlet System

When medical gas services are brought into non-clinical areas (including alternate care sites), pairing a high-capacity gas delivery system with an equipment rail outlet system is optimal.

Source: Paladin Healthcare, LLC

HVAC Systems

Health care facility HVAC systems are designed to provide thermal comfort for patients, staff, and visitors and to limit the spread of pathogens by providing adequate ventilation and filtration of building air. During the COVID-19 pandemic, the primary concerns regarding HVAC systems were their efficacy in filtering out microorganisms and their ability to create and maintain negative pressure in spaces where suspected or confirmed COVID-19 patients were being treated.

Most hospitals and nursing homes have a limited number of airborne infection isolation (AII) rooms. AII rooms, which are maintained

under negative pressure (i.e., air is pulled into the room and exhausted directly outdoors), are intended for isolation of patients with airborne diseases such as measles and chicken pox. Although it has been determined that COVID-19 does not require isolation in an AII room for routine care, it has been recommended that COVID-19 patients undergoing aerosol-generating procedures be treated in a negative pressure setting when possible. Thus, faced during the pandemic with increased need for AII rooms or other spaces where procedures could be performed under negative pressure, hospitals struggled to find inventive ways to convert patient rooms to meet negative pressure requirements. Potential solutions varied widely depending on the facility and the nature of the emergency at hand.

AII rooms are required to be maintained at 12 air changes per hour (ACH) with a minimum negative pressure differential of minus 0.01" w.c.; a local visual indicator of negative pressure is also required. AII rooms must be exhausted directly outside as indicated in ANSI/ASHRAE/ASHE Standard 170: *Ventilation of Health Care Facilities*. An exception may be made when a room is retrofitted and it is impractical to exhaust directly outdoors. If this occurs, exhausts must be filtered with high-efficiency particulate air (HEPA) filters.

Air filtration

HVAC systems use filters to remove contaminants from the air. Minimum filtration levels for air-handling equipment are specified in various ASHRAE codes: ANSI/ASHRAE Standard 62.1: *Ventilation for Acceptable Indoor Air Quality* for non-health care occupancies and ASHRAE Standard 170. Filters are rated by a Minimum Efficiency Reporting Value (MERV) based on the filter's ability to capture particles between 0.3 microns and 10 microns. ASHRAE codes specify the MERV rating required for HVAC systems in different types of spaces.

In response to the COVID-19 pandemic, some organizations considered increasing filtration levels in air-handling systems above the minimums required. When such decisions are considered, they should be made in collaboration with engineering and infection prevention specialists and be based on a DEVA. If the need for

additional filtration is identified by the DEVA, it should indicate high-risk locations where increased filtration would be most beneficial. Increasing filtration levels will impact energy efficiency and operating costs; therefore, changes should be made with careful consideration of cost vs. benefit.

In some cases during the COVID-19 pandemic, portable HEPA filtration machines were used. HEPA filters are a specialized type of filter that is 99.97 percent effective at filtering particles of 0.3 microns. Portable HEPA filtration equipment was used during the pandemic in two ways:

- To increase the rate of particle removal in a space by recirculating room air though the HEPA filter, which can be considered the equivalent of increasing the number of ACH in a room. Some organizations used this approach in standard rooms where aerosol-generating procedures were performed to shorten the room turnover time. Elsewhere, it was used in procedure rooms (which are positive pressure by design) as a means of reducing the risk of aerosol spread outside the room.
- To create additional, temporary negative pressure isolation rooms.

Negative pressure

As noted earlier, the COVID-19 pandemic generated a need for increased numbers of AII rooms and other negative pressure rooms. As the need was immediate, there was no time to fully renovate rooms to meet *Guidelines* requirements for AII rooms. Thus, temporary negative pressure rooms were created in several ways. Key to the success of this strategy is to have enough air supply and exhaust to allow this change, along with the flexible building controls needed to make it work. Because many hospitals struggle to maintain a good air balance in normal operating conditions, some of these techniques could require extensive system modifications.

One of the simplest techniques, although likely costly, adds an exhaust fan and external ductwork to the building. This achieves negative pressure without rebalancing the system. Concerns with

this approach are expense and the time required to add the ductwork and fan. Depending on the overall HVAC balance of the building, exhausting more air could create an imbalanced system and heating, cooling, and ventilation issues. In addition, depending on the location of the exhaust (e.g., near air intakes or pedestrian traffic outside the building), HEPA filtration might be required.

Another method rebalances a patient care area to create a negative pressure area in a given space, such as an ICU suite or a medical/surgical unit. This approach does not isolate individual patients; therefore, it is important to work with infection prevention staff to establish specific requirements for PPE use in common areas on the unit. The downside to making an entire unit negative is it could upset the HVAC balance in other areas of the hospital. It also requires resetting the balance after the emergency condition has ended. In this scenario, facility managers should collaborate with infection preventionists to determine the value of creating a negative pressure unit.

Assuming the hospital is using recirculated air and weather conditions are acceptable, another method converts the facility to 100 percent outside air and shuts down the return air dampers. An extra measure closes off the return duct; this would be done where the seals on the return dampers are suspect.

Emergency and Normal Electrical Power

Electrical systems are the lifeblood on which many of the previously mentioned hospital systems depend. Because disasters can quickly isolate facilities from commercial power grids, electric power redundancy is critical to patient and resident care and an essential electrical system (EES) has long been required by national electrical and health care facility codes as the means for that redundancy in health care facilities. The EES provides an alternate power source with carefully arranged branches to limit the risk of power loss to the most critical aspects of the hospital. This resilient design ensures hospitals are able to provide patient care and treatment during emergency conditions.

Historically, per national and local codes, hospitals are required to have an emergency power supply that automatically switches on during an electric utility outage to keep essential facility systems running. Understanding these basic requirements is important when planning for additional capacity.

Emergency power comprises only those loads required to be restored within 10 seconds—as required by NFPA 99: *Health Care Facilities Code* and NFPA 70: *National Electrical Code* (NEC) Article 700—and defined as the emergency system (life safety branch and critical branch) and equipment system by NEC Article 517 for hospitals. Hospitals provide the EES, which includes the standby power source (i.e., generators) and power distribution serving both the emergency system, which includes the life safety branch and the critical branch, and the equipment system. A hospital's critical branch comprises a large portion of the electrical distribution system and handles loads such as lighting, receptacles, and medical equipment in patient rooms, intensive care rooms, operating rooms, post-anesthesia care units, nurse stations, pharmacies, labs, blood banks, and other spaces where direct patient care or critical patient support services are provided.

NEC Articles 700 and 701 apply to all facility types, including hospitals. However, the requirements of NEC Article 517 are typically more stringent and apply only to hospitals and similar health care facilities (e.g., nursing homes, ambulatory surgery centers). It should be noted that NFPA 99: *Health Care Facilities Code* drives performance criteria for specific electrical requirements for hospitals on the EES, while NEC Article 517 covers construction and installation requirements for the EES.

One other code that affects generator design and installation is NFPA 110: *Standard for Emergency and Standby Power Systems*. This code is more specific to generator and transfer switch equipment installation requirements and not the essential electrical loads that must be connected to them; therefore, a health care organization must identify the anticipated future load of its facilities by applying NFPA 99 prior to selecting a generator and its associated equipment.

NFPA 99 identifies two different types of patient care areas—general care and critical care—which depend on the patient's acuity and need for care. A general care area includes rooms such as a standard patient room or an exam room where critical branch power is needed but the patient's condition is not severe. In a critical care area, the patient's care is more dependent on hospital staff and life-saving equipment and, thus, on connection to the EES. Critical care rooms include operating rooms, labor/delivery rooms, intensive care units, trauma rooms in emergency departments, etc. For these critical care spaces, NFPA 99 and NFPA 70 require a greater amount of normal and critical care emergency power. It is important that every health care organization have a strong understanding of how general patient care and critical patient care areas are classified and served and how each type of patient care space may be suitable for use during emergency and surge conditions.

Surge needs

The COVID-19 pandemic hit nearly every health care facility with unprecedented demands on electrical infrastructure. These demands were due in part to the need to shift patients, equipment, and resources to non-clinical areas of the facility and in part to the establishment of patient care and support spaces outside of traditional hospital locations. These activities required running temporary EES power to support these relocated general and critical care functions. Such rapid hospital expansion typically requires carefully planned designs for renovated or reconfigured spaces and additional beds, medical equipment, essential services, security, and so on; however, in a crisis people just "make it happen."

In most cases, any rapid renovation or expansion of a health or residential care facility or campus may quickly overwhelm the existing capacity of electrical infrastructure systems. The consequent need for additional electrical capacity may not be as obvious as expanded space needs, especially in the midst of an evolving situation. Therefore, proactive planning for rapid expansion events must be part of every organization's disaster preparedness and resiliency strategy. Having a plan of action to accommodate potential changes to a facility's physical infrastructure is a prudent

way to minimize the potential impact from overloading the EES in future surge events.

Recommendations and future considerations

Added treatment spaces, both inside and outside the building, will place new demand on all branches of the EES. This may affect the size of feeders, generator and transfer switch capacity, and even fuel capacity. Having a clear understanding of potential bottlenecks and limitations in the existing system will assist with both disaster planning and identification of potential options for remediation during emergency conditions and future expansion.

Extension of the EES into newly purposed patient treatment locations may require repurposing electrical circuits not typically supported by the life safety or critical branch. To address this issue, relocatable power taps (power strips) may be employed to extend critical power into these locations. Current health care codes limit the type and installation of relocatable power taps (e.g., see CMS regulations in the sidebar on the next page); thus, health care organizations would benefit from a clear plan of how and where to deploy them. Provision of some critical branch connections in potential surge treatment areas should be considered to ensure proper delivery of care if normal power is lost.

CMS Regulations re: Uses of Power Taps in Hospitals

State Operations Manual

Appendix A – Survey Protocol, Regulations and Interpretive Guidelines for Hospitals

...

A-0700

(Rev. 37, Issued: 10-17-08; Effective/Implementation Date: 10-17-08)

§482.41 Condition of Participation: Physical Environment

...

A-0701

(Rev. 176, Issued: 12-29-17, Effective: 12-29-17, Implementation: 12-29-17)

§482.41(a) Standard: Buildings

The condition of the physical plant and the overall hospital environment must be developed and maintained in such a manner that the safety and well-being of patients are assured.

Interpretive Guidelines §482.41(a)

...

If line-operated medical equipment is used in a patient care room/area, inside the patient care vicinity:

- UL power strips would have to be a permanent component of a rack-, table-, pedestal-, or cart-mounted & tested medical equipment assembly
- Power strips providing power to medical equipment in a patient care room/area must be UL 1363A or UL 60601-1
- Power strips cannot be used for non-medical equipment

If line-operated medical equipment is used in a patient care room/area, outside the patient care vicinity:

- UL power strips could be used for medical & non-medical equipment with precautions as described in the memo
- Power strips providing power to medical equipment in a patient care room/area must be UL 1363A or UL 60601-1
- Power strips providing power to non-medical equipment in a patient care room/area must be UL 1363

If line-operated medical equipment is not used in a patient care room/area, inside and outside the patient care vicinity:

- UL power strips could be used with precautions

Power strips providing power to non-medical equipment in a patient care room/area must be UL 1363. In non-patient care areas/rooms,

other UL strips could be used with the general precautions.

From *CMS Conditions of Participation,* https://www.cms.gov/Regulations-and-Guidance/Guidance/Manuals/Downloads/som107ap_a_hospitals.pdf

Health care organizations should also consider the extent to which other infrastructure systems are connected to the equipment system. This includes heating and refrigeration and ventilation systems; elevators; and other systems where interruption could create a hazardous condition for staff and patients or hamper rescue or firefighting operations.

Additional task illumination, receptacles, or special power circuits that may be considered essential for effective facility operations could be connected to the critical branch. Health care organizations should carefully consider expanding the coverage of critical power to items deemed essential for emergency conditions according to their emergency operations plan. Actions to provide additional power to the critical branch or equipment system in response to a disaster should be cautious as this may cause overloading of the standby power system. Development of a well-thought-out plan prior to an emergency event is crucial to sustaining overall electrical system performance.

Simple tasks such as testing the reliability of emergency and uninterruptible power supplies and information technology network resilience are vitally important to ensure continuous operations during normal and surge conditions. These tasks are part of scheduled maintenance infrastructure operations. Experience has proved that a health care organization's preparedness program must include a robust routine maintenance program that considers past and current building redevelopment and retrofitting activities as well as the impact of new construction.

In summary, changes to a hospital's primary functions during an emergency condition are much more frequent and can be more impactful than most organizations understand or have planned for. While new technologies and treatments come and go, the building infrastructure changes less frequently. Natural disasters, mass

casualties, pandemics, or other types of emergency events affect a facility's power demand. As a result, electrical distribution systems must be designed with extra flexibility and spare capacity to help accommodate load growth, changes, and unanticipated events. Defining the right-sized systems for normal and surge conditions is a critical planning need.

Partnerships

As health care organizations and designers evaluate successes and failures during emergency events, organizations may find it advisable to develop working partnerships with other relevant entities to better prepare for future events. Partnerships to consider could be with transportation companies to transport staff when public transportation systems are closed or unsafe during emergency conditions, vendors to provide pre-packaged meals or other food services when supply lines are disrupted, local warehouse spaces for additional supply storage, and local hotels for any additional housing needs.

During the COVID-19 pandemic, some organizations partnered with nearby hotels to quarantine patients whose results were not yet conclusive as well as COVID-19 positive patients requiring separation from the general patient population. This arrangement put an additional burden on both staffing and the supply chain (e.g., getting PPE to the site and storing it safely and under appropriate environmental conditions). It also created potential health risks for the personnel involved in moving positive patients between locations. Considering partnerships that could help accommodate patient and facility needs during an emergency event before such an event occurs can smooth implementation when the need arises.

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Proposed Language Based on the 2018 Hospital *Guidelines*

The proposed new language below shows changes to the 2018 FGI *Guidelines* recommended by the surge capacity subcommittee of the Emergency Conditions Committee. Additions are underlined, and deletions indicated with a ~~strikethrough~~. Where an appendix item (i.e., a non-enforceable recommendation or guidance on applying a requirement) has been provided, an asterisk (*) precedes the section number (e.g., *1.2-4 Safety Risk Assessment). Appendix items can be identified by the letter "A" that precedes the correlating section number (e.g., A1.2-4 SRA). The text shown has been excerpted from the 2018 *Guidelines* and is not comprehensive. These proposed changes have been adapted and incorporated with recommended changes from other subcommittees in the draft *Guidelines for Emergency Conditions in Health and Residential Care Facilities* in the last section of this white paper.

***1.2-5.4.3 Wayfinding**

How clarity of access will be provided for the entire campus or facility using a wayfinding system. See Section 1.2-6.3 (Wayfinding) for more information.

A1.2-5.4.3 Wayfinding

a. Hospital entry points should be clearly identified from all major exterior circulation modes (e.g., roadways, bus stops, vehicular parking).

b. Clearly visible and understandable signage, icons, universal symbols, visual landmarks (including views to the outside), and/or cues for orientation (including views to the outside) should be provided.

c. Boundaries between public and private areas should be well marked or implied and clearly distinguished.

d. A system of interior "landmarks" should be developed to aid occupants in cognitive understanding of destinations. To be effective, landmarks should be unique and used only at decision points. Landmarks may include sealed water features, major art, distinctive color, or decorative treatments. These features should attempt to involve tactile, auditory, and language cues as well as visual recognition. When color is used as a wayfinding device, it should support the primary wayfinding system elements and be clearly distinguished from color palette decisions unrelated to wayfinding.

e. Signage systems should be flexible, expandable, adaptable, and easy to maintain. Signage should be consistent with other patient communications and supporting print, Web, and electronic media.

f. Health care organizations should consider how signage and wayfinding can be adapted during a disaster to provide meaningful real-time information for patients and staff. Consider a temporary signage plan that identifies the following:

—New uses and functions

—Zones of use, including but not limited to:

- Staff zone
- Public zone
- "Clean" vs "contaminated" zones

1.2-6.5 Emergency Preparedness and Management

***1.2-6.5.1 Planning and Design Considerations**

During project planning and design, the following shall be considered:

1.2-6.5.1.1 The likelihood that a facility will experience events that go beyond a facility's normal operations

***1.2-6.5.1.2** Space needs in the event of an emergency for operations to:

(1) ~~**1.2-6.5.2.1**~~ Protect facility occupants during the event

(2) ~~***1.2-6.5.2.2**~~ Continue providing services

***1.2-6.5.1.3** Infrastructure needed to convert a non-clinical space for use as a patient care area, including:

(1) Emergency power

(2) Access to medical gases

(3) Ventilation

(4) Environmental controls

> **A1.2-6.5.1.3** Health care organizations should consider which areas of the facility are likely to be converted to patient care in the event of a disaster. These spaces are not intended for everyday patient care, resolution of capacity issues that are a result of poor planning, or routine forecastable surge events (e.g., seasonal flu surge). The increase in capacity provided by the systems should meet the requirements in Section 2.1-8.1.2 (Surge Capacity Locations).

***1.2-6.5.1.4** Space for an incident command center. Every health care organization shall identify one room that can be used as an incident command center during an emergency.

(1) The room shall have a minimum clear floor area of 200 square feet.

(2) This room shall be permitted to serve other functions (e.g., a conference or training room) during normal conditions.

A1.2-6.5.1.4 Incident command center. The widespread use and adoption of the Hospital Incident Command System (HICS) into health care emergency response plans necessitates allocating sufficient space to house the HICS team during an emergency. Commonly, the space used for an incident command center is a conference room located in a securable staff area that can be repurposed as needed. The room should be sized based on maximum space needed and provide emergency power, lighting, and access to IT infrastructure.

1.2-6.5 Emergency Preparedness and Management

...

1.2-6.5.2 Critical Function Areas

1.2-6.5.2.1 New construction. The following critical function areas shall be located at an elevation above the 100-year floodplain and storm surge level:

(1) Pharmacy

(2) Laboratory

(3) Blood bank/storage

(4) Sterile processing facilities

1.2-6.5.2.2 Renovations. In renovations of existing facilities, critical function areas shall be relocated above the floodplain or storm surge elevation unless infeasible or space does not permit. In this situation, the health care organization shall create a mitigation plan to ensure continuity of service.

***1.3-3.8 Exterior Surge Capacity Locations**

1.3-3.8.1 Health care organizations shall identify locations that will be used for temporary or mobile structures during a disaster.

1.3-3.8.2 A disaster, emergency, and vulnerability assessment (DEVA) shall be performed to consider:

1.3-3.8.2.1 Potential site and favorable uses

1.3-3.8.2.2 Potential utility connections

1.3-3.8.2.3 Potential traffic disruptions and crowd control concerns

> **A1.3-3.8 Exterior surge capacity locations.** Health care organizations should plan for adaptation of site features during an emergency event. This includes spaces for mobile or modular units and temporary structures like tents or vehicles.
>
> Typically, infrastructure-intensive, overnight care is provided within the existing walls of a hospital during a surge event. Transitory, outpatient care may be housed in temporary structures with little infrastructure and limited environmental controls. Other functions that may be augmented by use of temporary mobile units include support spaces for services such as laundry. cleaning, soiled materials decontamination, morgue, and food preparation. Storage and other less critical functions can also be relocated from the hospital to open up space for surge patient care during an event. Staff staging can also be accommodated outside the hospital.
>
> Health care organizations should be thoughtful about how temporary external assets are arranged so proximity to utility and infrastructure hookups can be provided. Careful attention should be paid to security, crowd control, and access, including visual observation of sensitive functions

(e.g., morgue and body transport, access to hospital leadership).

***2.1-2.4.2 Airborne Infection Isolation (AII) Room**

...

***2.1-2.4.2.6 Means for communication.** The design of isolation rooms shall provide for verbal and visual communication between patient and staff without the staff member having to be in the room with the patient.

A2.1-2.4.2.6 Means for communication in an isolation room. The goal is to reduce the number of times staff must enter a patient room, reducing exposure to airborne disease as well as the need to don and doff PPE. One solution is to provide windows so staff can maintain visual contact with the patient. Verbal communication can be achieved with a nurse call system, cellular phones, or other electronic means.

2.1-4.2 Pharmacy Services

...

***2.1-4.2.2 Pharmacy Areas**

A2.1-4.2.2 Pharmacies should be considered vulnerable areas during emergencies. Regardless of whether they contain narcotics or not, intruders could be seeking medications. As well, consideration must be given to security issues during times of civil unrest. Although pharmacies located inside a hospital may be more secure from intruders, security for emergency conditions should still be considered.

Security recommendations include providing bulletproof glass in pharmacy transaction windows and perimeter security features such as full height walls with anti-breach measures (e.g., plywood, security mesh). External windows should be given the same considerations.

2.1-4.3.2 Food Preparation Areas

…

2.1-4.3.2.5 Hand-washing stations

(1) Hand-washing stations shall be provided within 20 feet (6.10 meters) of each food preparation or serving area.

(2) Hand-washing stations shall be located so as to not require reaching, touching, or crossing to another preparation station.

(3) Hand-washing stations may be shared between adjacent food preparation stations.

***2.1-4.3.5 Dining Areas**

A2.1-4.3.5 Alternate uses of dining areas during an emergency condition. During a natural disaster or other emergency condition, dining areas may need to be repurposed to non-food service uses such as emergency care or inpatient care. Project planning should include consideration of the features and services (e.g., medical gases, power, privacy, HVAC controls) that would be required to make such an alternative care arrangement functional. In addition, consideration should be made for movable seating and tables to accommodate additional space when needed.

2.1-4.3.5.1 Dining space(s) shall be provided for ambulatory patients, staff, and visitors.

2.1-4.3.5.2 A minimum aisle spacing and chair clearance of 3 feet (91.5 centimeters) shall be provided, but also be expandable to accommodate physical distancing as may be necessary during an infectious disease event.

2.1-4.3.5.3 The design of aisles, tables/chairs, and casework used for self-service shall accommodate wheelchair access. See Section 1.1-4.1 (Design Standards for Accessibility).

2.1-4.3.8.13 Food and supply storage

…

(2) Refrigeration equipment

(a) Refrigeration equipment shall be on an uninterrupted power source.

~~(a)~~ (b) Refrigerators and freezers shall be thermostatically controlled to maintain temperature settings in increments of 2 degrees or less.

~~(b)~~ (c) Commercial-grade refrigeration shall be provided to hold chilled and frozen food at temperatures in accordance with local, state, and federal requirements, including "HACCP [Hazardous Analysis Critical Control Point] Principles & Application Guidelines" and the FDA "Food Code."

…

(4) Emergency storage. The following shall be provided ~~as~~ for 96 hours or the time determined in the design phase:

(a) Storage space sufficient to hold food and water supplies to

feed the entire patient and staff population, along with their families

~~(a)~~ (b) Storage for emergency or disaster food, disposable dishes, cutlery, trays, and water

~~(b)~~ (c) Emergency utility support for refrigerated storage and food preparation and serving areas

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***2.1-5.3 Materials Management**

…

2.1-5.3.3 Central Storage Facilities

***2.1-5.3.3.1 General**

(1) In addition to supply storage facilities located in individual departments, a central facility for general storage shall be provided.

(2) Location of central storage facilities in a separate building on-site shall be permitted as long as provisions are made for protection against inclement weather during transfer of supplies to the hospital.

(3) The impact of disasters, supply shortages, and other supply chain interruptions shall be considered when sizing facility storage.

A2.1-5.3.3.1 Supplies for emergencies. During planning for central storage facilities, consideration for storage of emergency preparedness supplies, linens, etc., should be included. Emergency preparation storage may be located off-site provided a transportation plan is in place for accessing the supplies.

Health care organizations should carefully consider disaster risk factors for each location, structure, and supply path when designing storage facilities to ensure supply

continuity. Additional considerations include emergency power sources for storage facilities, location of floodplains, and the structural integrity of the warehouse and bridges, overpasses, and other structures along the supply path.

2.1-5.7 Morgue Services

...

2.1-5.7.2 Autopsy Facilities

If autopsies are performed in the hospital, the following elements shall be provided:

***2.1-5.7.2.1 Refrigerated facilities for body holding.**

Body-holding refrigerators shall be equipped with temperature-monitoring and alarm signals that annunciate at a 24-hour staffed location.

A2.1-5.7.2.1 Emergency power. Consideration should be given to placing body-holding refrigerators on emergency power in case of loss of normal power during times of emergency.

2.1-6.2.2 Reception Area or Lobby

2.1-6.2.2.1 This space shall include the following:

(1) Access to information

(2) Public waiting area(s)

(3) Public toilet room(s)

(4) Provisions for telephone access

(5) Provisions for drinking water

(6) Outlets for charging cell phones and mobile devices

2.1-8 Building Systems

2.1-8.1 General

2.1-8.1.1 Psychiatric Patient Locations

In psychiatric patient rooms, toilet rooms, and seclusion rooms, ceiling and air distribution devices, lighting fixtures, sprinkler heads, and other appurtenances shall be of a tamper- and ligature-resistant type.

2.1-8.1.2 Surge Capacity Locations

In areas identified as surge capacity locations, medical gas or electrical outlets used to support surge capacity patient care areas shall be installed in a secured, tamper-resistant housing.

2.1-8.1.2.1 The tamper-resistant housing shall be designed for quick removal by facility maintenance staff to provide full and complete access to inspect, maintain, and use the outlets.

2.1-8.1.2.2 The housing shall not violate the outlet or fixture manufacturer's recommendations.

2.1-8.1.2.3 The housing shall not obstruct any means of egress.

***2.2-2.2 Medical/Surgical Patient Care Unit**

…

***2.2-2.2.2 Patient Room**

A2.2-2.2.2 Telemetry systems. Health care organizations should consider the addition of telemetry infrastructure in certain patient rooms to enable quick conversion to critical care during an emergency event. In some disaster scenarios, patient rooms are converted to a higher acuity level to accommodate patient surge.

…

***2.2-2.2.2.9 Infrastructure to support IV pumps and monitors.** Means shall be provided to locate IV pumps and monitors outside of patient rooms.

A2.2-2.2.2.9 Location of IV pumps and monitors outside patient rooms. During an epidemic, providing staff a means to monitor patients without entering the patient room supports the need to protect staff health and conserve personal protective equipment (PPE). The solution should include consideration of the location of emergency electrical power for monitors and IV pumps as well as fluid tubing from pumps or ventilators. The design should also make it possible to keep the required air balance in the patient room. One possible solution would be a sleeve though the wall for the equipment cables and tubing.

Chapter 2.8, Specific Requirements for Mobile/Transportable Medical Units

***2.8-1.3 Site**

A2.8-1.3 Disaster planning. Health care organizations should consider the use of mobile and relocatable unit utilities and unit pads during a disaster event to allow space for additional patient care capacity in the facility.

Proposed Language Based on the 2018 Outpatient *Guidelines*

***2.1-6.2 Public Areas**

The following shall be provided:

…

2.1-6.2.8 Provisions for Charging Personal Devices

Outlets for charging cell phones and mobile devices shall be made available.

***1.2-5.4.3 Wayfinding**

How clarity of access will be provided for the entire campus or facility using a wayfinding system. See Section 1.2-6.3 (Wayfinding) for more information.

A1.2-5.4.3 Wayfinding

a. Outpatient facility entry points should be clearly identified from all major exterior circulation modes (e.g., roadways, bus stops, vehicular parking).

b. Clearly visible and understandable signage, icons, universal symbols, visual landmarks (including views to the outside), and/or cues for orientation (including views to the outside) should be provided.

c. Boundaries between public and private areas should be well marked or implied and clearly distinguished.

d. A system of interior "landmarks" should be developed

to aid occupants in cognitive understanding of destinations. To be effective, landmarks should be unique and used only at decision points. Landmarks may include sealed water features, major art, distinctive color, or decorative treatments. These features should attempt to involve tactile, auditory, and language cues as well as visual recognition. When color is used as a wayfinding device, it should support the primary wayfinding system elements and be clearly distinguished from color palette decisions unrelated to wayfinding.

e. Signage systems should be flexible, expandable, adaptable, and easy to maintain. Signage should be consistent with other patient communications and supporting print, Web, and electronic media.

f. Health care organizations should consider how signage and wayfinding can be adapted during a disaster to provide meaningful real-time information for patients and staff. Consider a temporary signage plan that identifies the following:

—New uses and functions

—Zones of use, including but not limited to:

- Staff zone
- Public zone
- "Clean" vs "contaminated" zones

Proposed Language Based on the 2018 Residential *Guidelines*

***1.2-5.4.3 Signage and Wayfinding**

A1.2-5.4.3 Signage and wayfinding

a. entry points to all residential health, care, and support facilities should be clearly identifiable from all major exterior circulation modes (e.g., roadways, bus stops, vehicular parking).

b. Planning for wayfinding should begin with the concept that the average visitor or staff member will be able to easily find his or her way throughout the facility.

c. Outside wayfinding should be considered for both those walking and those driving to the facility. If public transportation is available, directions and signage to and from transportation sites should be provided.

d. Care provider organizations should consider how signage and wayfinding can be adapted during a disaster to provide meaningful real-time information for residents and staff. Consider a temporary signage plan that identifies the following:

—New uses and functions

—Zones of use, including but not limited to:

- Staff zone
- Public zone

—"Clean" vs "contaminated" zones

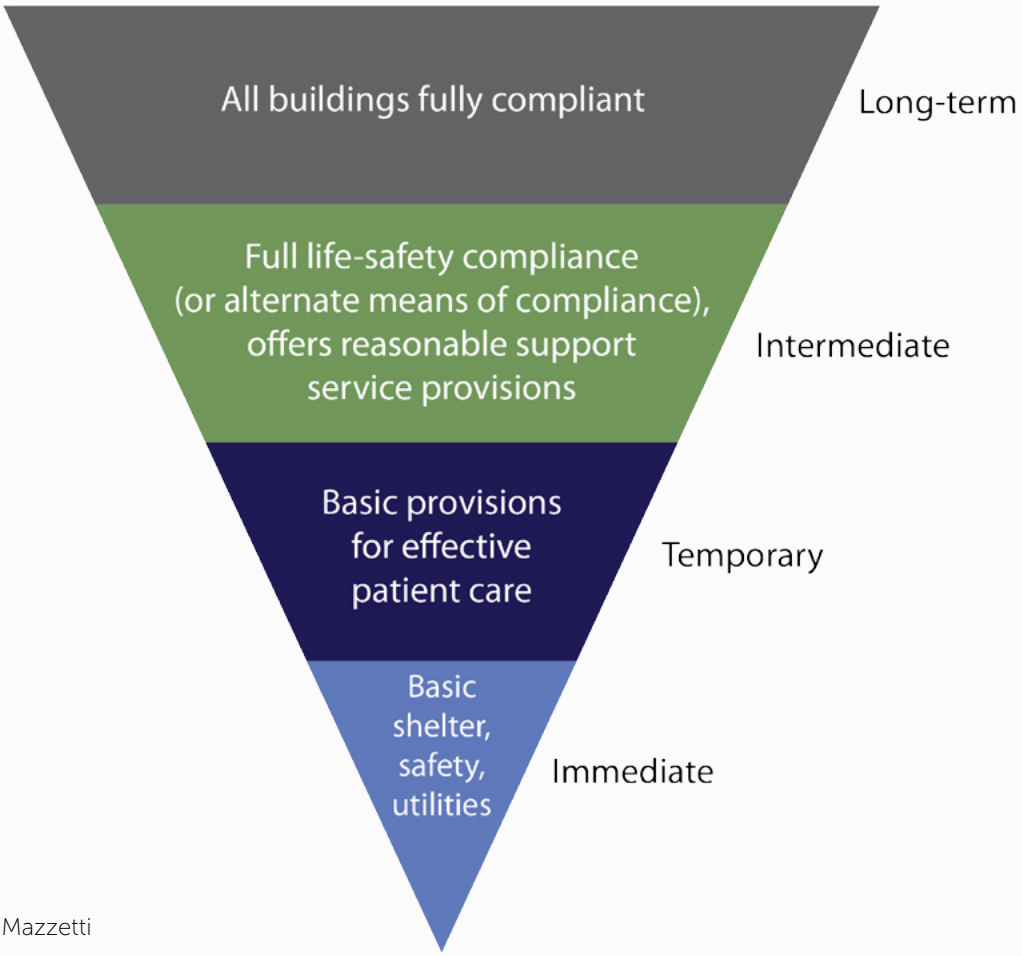
Chapter 3: Alternate Care Sites

The preferred solution for managing a surge event is to treat overflow patients within the established confines of a licensed health care facility; this may require converting one space into another (e.g., an OR into a functional intensive care unit). In emergency situations during which providing care in an established, licensed health care facility is not feasible, the next best alternative is to route patient care to code-compliant spaces designed to offer care services equal to those provided by other health care facilities in the region. When such diversion strategies are unavailable or insufficient to meet the need for patient care spaces, use of alternate care sites such as mobile/transportable medical units and pre-approved modular structures may be needed.

An alternate care site (ACS) is defined here as any building or structure that is temporarily converted, constructed, or altered for health and/or long-term residential care use during a public health emergency. Note that this definition does not align precisely with similar definitions created by the U.S. Centers for Disease Control and Prevention (CDC),[1] American Society for Health

Care Engineering (ASHE),[2] or U.S. Army Corps of Engineers (USACE).[3] The subcommittee on alternate care sites chose to use the aforementioned definition for two reasons: First, the conversion of a hospital's administrative and support spaces to patient care areas has been addressed in specific terms in the surge capacity chapter of this document, and second, this document considers long-term residential care facilities, which the definitions put forward by the CDC and USACE do not. For the purposes of this document, then, alternate care sites do not include new conventional construction, but focus on the creation of temporary structures and the repurposing of existing facilities for the duration of an emergency event.

Figure 3-1: Hierarchy of Needs for Alternate Care Sites



Source: Mazzetti

Given the definition established above, it is understood that an ACS will not be fully compliant with the FGI *Guidelines for Design and Construction* documents. Wherever possible, the subcommittee recommends delivering care in code-compliant spaces, but we recognize that emergency situations will, at times, require health care organizations to make do with the best available options in order to provide needed health care services. Such emergency situations, during which needs for compliance often evolve over time, can be viewed through an inverted version of Maslow's hierarchy of needs in which the ACS hierarchy shows the compliance stages—with guidance on appropriate timeframes—when treating patients or caring for long-term care residents in an alternate care site. As represented in Figure 3-1, when needs are "immediate" but code-compliant facilities are unavailable, facilities that protect basic life safety may be an acceptable location for response. However, the longer an emergency event lasts, the less acceptable it becomes to treat patients in non-compliant spaces.

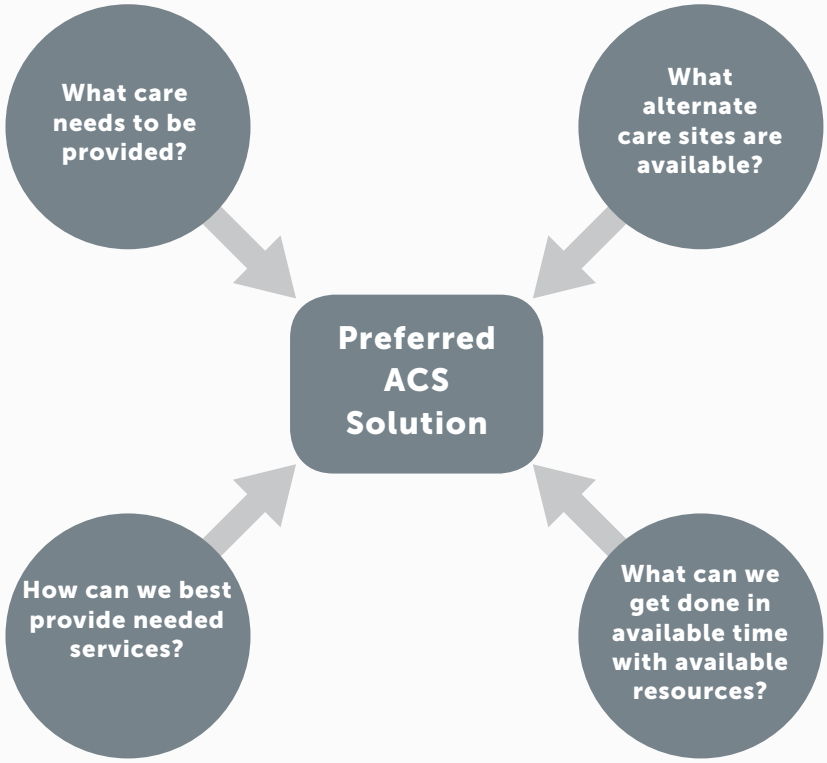
The key to successfully deploying an alternate care site is choosing the solution best suited to the emergency event at hand, the solution's projected timeframe for use, and the acuity of the patient population. In many cases, the solution will necessarily evolve as timeframes extend. The goal must be to provide spaces that are as code compliant as possible during a given emergency event.

Structures that may be considered for use as an ACS include tents and other membrane structures, arenas and convention centers, community centers, hotels, relocatable structures (e.g., Butler® buildings and office trailers), schools, barracks and dormitories, prisons, and decommissioned hospitals. In this chapter, these facilities are grouped into the following building typologies: tents and other membrane structures, repurposed structures (i.e., large-span structures, structures with many small rooms, recommissioned or repurposed medical buildings), and modular facilities.

Variables to assess when evaluating options for an ACS include community need, the health or residential care organization's risk tolerance, characteristics of the anticipated emergency, the feasibility of conversion, distance to the ACS site, expected costs,

patient/resident population, time required for implementation, and anticipated length of use. Most important, the ability to accommodate patient surges will depend on the availability of staff, equipment, and supplies. An aggregated approach to effectively selecting an ACS is depicted in Figure 3-2.

Figure 3-2: Factors Influencing ACS Choice



Sections in this chapter discuss planning and operational issues specific to alternate care sites and the unique compliance considerations for activating them. The aim of the chapter is to provide organizations with guidance that helps them determine what solutions are available and best suited to serve as an ACS. A secondary goal is to provide tools to help organizations quickly decide which ACS approach will best serve their facility when preparing for or responding to an emergency event. Case studies (see appendices 3-1 to 3-7) illustrate solutions employed during previous emergency events with varying degrees of success.

Operational Considerations

Operational planning considerations for deploying an ACS (including site assessment and selection and assessment of transportation, communication, and equipment needs) should be included in an organization's existing emergency operations plan (EOP). The EOP should address levels of response needed based on incident type,[4] including complete evacuation of a facility to an ACS.

Organizations should identify deployment teams and needed resources based on anticipated incident levels. Operational considerations include those described here:

Transportation Resources

A safe and established route of transport for patients, staff, and equipment and supplies from the health or residential facility to the ACS should be determined.

ACS Support Resources

When the ACS is an existing structure, the health care organization should work with the building manager and engineering staff to "understand key systems in the building and emergency procedures for each such as water, power, phone, internet for patients, fire suppression systems, and evacuation plans that include accessible methods of evacuation for people with disabilities, people who may be on ventilators, and people with other access and functional needs."[5]

Health Care Organization Support Resources

Care should be taken to minimize logistical demands while the ACS is in use, particularly during the often-chaotic 72 hours after an emergency event begins. Storing specialty carts stocked with personal protective equipment (PPE), basic supplies, and portable

oxygen and suction devices that can be easily transported to a predetermined ACS can greatly simplify the activation of these sites with minimal impact on the primary facility's operations. Other services for which similar plans should be considered include laundry and food services, waste management, and provision of additional supplies that may be needed during an emergency event.

Staffing Resources

It's a safe assumption that if an ACS is activated, the primary facility is also in a heightened state of alert. Under such conditions, the health care organization should anticipate minimal resources will be available to serve both facilities. Thus, it is important for the organization's EOP to include provisions for the communications equipment and personnel required to staff a satellite incident command center at the ACS. This will facilitate communications with the organization's main incident command center and streamline operational processes.

Key operational questions to consider when planning for an ACS as part of the emergency operations plan are:

- When is a patient surge expected? How long would the surge last?
- What is the anticipated caseload and pathology of patients during the surge?
- What is the expected acuity level of the patient population to be treated in the ACS?
- What is the likelihood the ACS will also be affected by the emergency event? Will that limit its ability to serve as an ACS?
- How long will the ACS be expected to function? Is the selected structure appropriate and viable for the anticipated timeframe?
- What is the distance from the selected ACS to the nearest hospital? Are there site or access conditions that may make the travel slow and/or difficult?

- What is the anticipated cost to procure the site?
- To what extent will the site or facility need to be altered to meet programmatic needs?
- What resources will be required to plan, design, and construct or renovate the ACS?
- What is the estimated time to deploy the ACS? Be sure to consider the impact of the event on materials and the workforce.
- What logistics must be considered to assure the site has the necessary equipment, staff, and supplies as well as sterile processing, dining, laundry, and environmental services?
- Is the owner of the selected site or facility willing to execute an agreement that allows for its use as a temporary health care site?
- What will be required to return the ACS to its original state once the emergency has passed and normal operations have resumed?

Compliance Considerations

In normal circumstances, U.S. building codes require a change of occupancy classification (e.g., from convention center to hospital) and compliance with minimum requirements for new construction when a structure is used for other than its original purpose. Obviously, deployment of health care operations in a non-health care space is a change of occupancy. Thus, when an organization intends to temporarily use an ACS to respond to an emergency event, the intent of applicable building codes should be met to the greatest extent possible. Where this is not possible, the organization should work with the authority having jurisdiction (AHJ) to obtain a waiver.

Although compromises will likely need to be made during rapid construction or adaptation of an ACS, inattention to code compliance during ACS planning can result in wasted time, resources, and—possibly—lives. For example, if a structure intended

for use as an ACS can only provide significantly compromised clearances, adaptation of the structure will likely result in non-functional, non-compliant spaces that cannot be used.

Determining When to Activate an ACS

The potential concessions in code compliance that may result from deploying to an ACS should make this solution the last resort when a facility has exceeded its surge capacity. However, to achieve the best outcome when an ACS must be employed, a health care organization should make decisions well in advance of any anticipated emergency events as part of emergency preparedness planning.

Planning for an organizational response to emergency conditions begins with review of the hazard vulnerability assessment (HVA)[6] required by CMS and development of a disaster, emergency, and vulnerability assessment (DEVA), which facilitates consideration of the relative likelihood and impacts of all possible hazards and how an organization should prepare for an all-hazards response. Most CMS-certified facilities[5] must also have an EOP in place. See Chapter 1 in this document for more information.

Prior to the COVID-19 pandemic, the need for an ACS was rarely considered during emergency preparedness planning, but the unexpected levels of patient surge seen during the pandemic have revealed why health care organizations should include such provisions in future planning efforts. If an organization's risk assessment process identifies a strong likelihood the community and/or organization will experience a future event requiring delivery of patient care outside the facility's footprint, possible alternate care sites should be identified and analyzed as part of its emergency preparedness planning.

Questions for Evaluating Potential Alternate Care Sites

An organization will need to carefully consider the following questions as it evaluates potential alternate care sites for use during emergency events:

- What is the anticipated scope of the event? Is it a one-time occurrence of limited duration (e.g., fire, tornado, tsunami, mass casualty event) or a long-term public health crisis (e.g., pandemic)?
- Will the impact be local, regional, statewide, national, or global? Will the scale of the event prevent transfer of patients to other health care facilities?
- Is the event likely to injure individuals and damage health care facilities?
- How will damage or destruction of health care facilities affect demand for and delivery of services?
- What is the expected duration of the event? Will health care demand be elevated for a long period? Or will demand wane quickly after a localized surge?
- Will the anticipated event impact the delivery of goods and services (including utilities)?

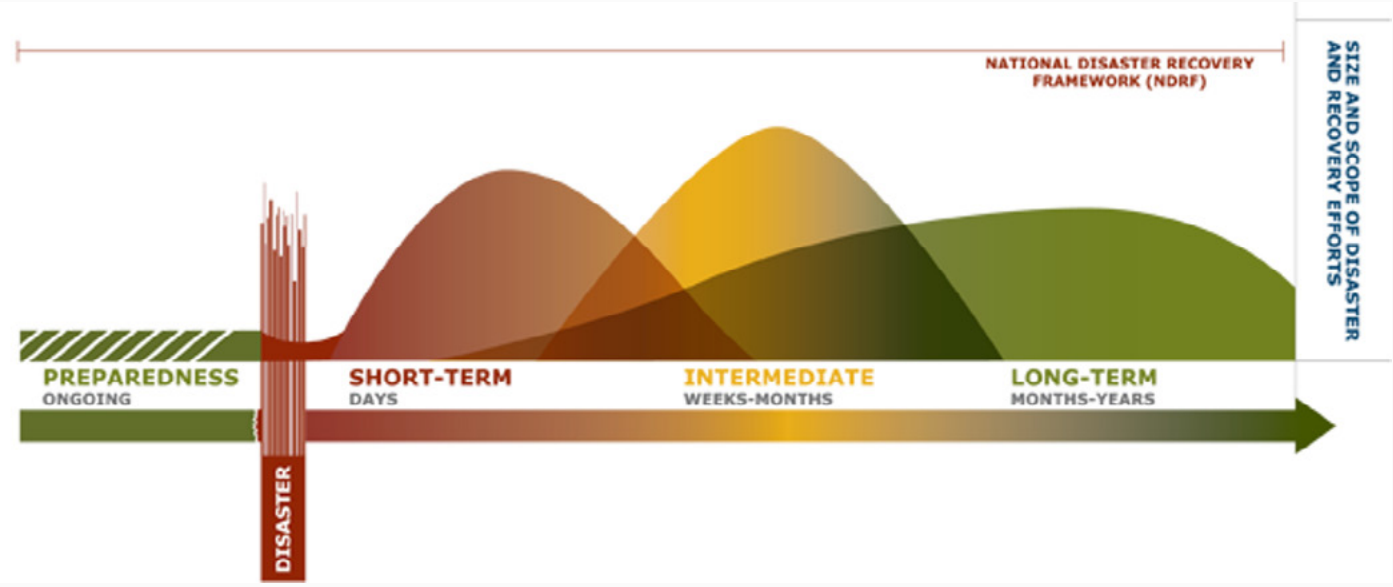
Deploying an ACS

When unanticipated events force a health care organization to deploy an ACS, the organization must carefully balance a wide range of factors in a very short period. Generally speaking, at the outset of an emergency, the organization will implement its EOP, which should include an outline of processes for setting up an incident command center, diverting patients, repurposing spaces inside the existing facility, and deploying an ACS. At this time, organizations will need to work closely with the local AHJ to assure the ACS meets basic life safety requirements and is acceptable for its intended use, expected duration of use, and population served.

A continuum from initial emergency response into recovery

The Federal Emergency Management Agency (FEMA) is often involved in public assistance during emergencies, and its National Disaster Recovery Framework illustrates the overlapping duration of emergency responses and recovery efforts (Figure 3-3). The timelines identified are intended to provide enforcement officials with flexibility and discretion to support health care facilities as they strive to meet the emergent health care needs of a community after an emergency event.

Figure 3-3: Recovery Continuum Per the National Disaster Recovery Framework



Source: Federal Emergency Management Agency

The four response and recovery stages shown in Figure 3-3 are described as follows; examples are provided in appendices 3-1, 3-2, and 3-3.

- ***Short-term—immediate.*** These are emergency efforts to triage, treat, and sustain life in response to the precipitating event. Facilities that are deployed for these efforts range from tents to mobile units. The duration of their deployment can be

measured in hours or days after a declared emergency. It is not anticipated that code requirements will be applied to these solutions.

- ***Short-term—temporary.*** These responses are intended to be in place for no more than 60 days after a declared emergency. They may provide medically necessary treatment to those directly affected by the event and others in the community with conditions that require immediate medical attention. As "temporary" locations, these solutions may not be subject to building code requirements but are expected to make reasonable efforts to address basic life safety requirements and provide for the health and well-being of patients, residents, and clinical staff.
- ***Intermediate.*** These responses are intended to be completed as soon as possible after an emergency declaration and remain in use for an initial period of no more than six months. It is anticipated these solutions will be designed and constructed to comply with the codes that are minimally necessary given the use or services for which the facility is intended.
- ***Long-term/permanent.*** These responses must be designed and constructed in full compliance with applicable building codes.

Health care providers may use the compliance assessment matrix shown in Figure 3-4 to assess code compliance requirements for an ACS during and after an emergency event. The following issues should also be considered when using this matrix:

- During emergency planning, the organization should identify potential sites for surge space. The organization should have some idea of which clinical modalities could best be deployed into these locations.
- Ideally, the organization should have discussions with the entities that control identified sites so that necessary actions can be initiated relatively quickly during an emergency event.
- The compliance matrix is meant to be used both before and after the immediate onset of an emergency event in an iterative process comparing anticipated surge characteristics with the characteristics of the ACSs available for use.

Figure 3-4: Alternate Care Site Compliance Assessment Matrix

Alternate Care Site Compliance Assessment Matrix

Program Statement:
Acuity of Patient Population:
Date of Deployment:
Duration of Care:
Facility Type:
Date of Assessment:

COMPLIANCE GUIDELINES PER SERVICE AND DURATION		SHORT-TERM (Measured in hours or days after an event)						INTERMEDIATE			LONG-TERM Permanent (> 6 months)		
		Immediate			Temporary								
1. Confirm required approval entities. 2. Determine criteria for deploying to the ACS. 3. Identify risk tolerance for each group (see the disaster, emergency, and vulnerability assessment - DEVA). 4. Select columns to the right based on duration of anticipated stay. 5. Modify compliance categories in alignment with the DEVA.		Immediate response measured in hours or days after an event			Temporary response in service no more than 60 days			Temporary response put into service within 90 days and intended for no more than 6 months. An extension may apply (see _____)			Permanent response intended for 6 months or longer		
Service Use Type	**Description of Service**	**Group I**	**Group II**	**Group III**	**Group I**	**Group II**	**Group III**	**Group I**	**Group II**	**Group III**	**Group I**	**Group II**	**Group III**
Site Analysis	Building access				Per the DEVA			Per the DEVA					
	Site access												
	Parking												
	Perimeter security												
Building Systems	Mechanical/electrical/plumbing (MEP), fire protection				Per the DEVA			Per the DEVA					
	Low-voltage/security												
Patient Provisions	ADA				Per the DEVA			Per the DEVA					
	Accommodations for individuals of size												
Intake/Assessment	Intake/evaluation												
	Triage												
	Patient holding												
	Stabilization												
	Donning and doffing												
Emergency Services	Exam/treatment												
	Observation												
	Trauma/resuscitation												
Diagnostic and Treatment	General exam/testing												
	Treatment												
	Diagnostic imaging												
	Nuclear medicine/radiation												
	Interventional radiology												
	Non-invasive procedure												
	Invasive procedure/surgery												
	Pre/post-procedure care												
	Infusion												
	Hyperbaric												
	Dialysis												
	Pharmacy services												
	Respiratory therapy												
Inpatient Care	Critical care												
	Intermediate/transitional care												
	Medical/surgical												
	Protective environment (PE)												
	Airborne infectious isolation (AII)												
	Labor/delivery/recovery (LDR)												
	Behavioral health												
Public and Administrative	Waiting												
	Staff support												
	Administrative offices												
General Support	Sterile processing												
	Linen services												
	Materials management												
	Waste management												
	Environmental services												
	Food service												
	Morgue												
	Areas of respite												
	Family liaison/support												
	Supply receiving area												

Triage, treat, and sustain life in response to an event. Intent is to stabilize for transfer to a compliant medical facility. Due to emergency need and limited expected duration, application of code requirements not expected. Expected use will dictate what compliance will be provided.

This matrix highlights the recommended compliance strategies for alternate care sites that support patient care services within the specified timeframes of an emergency response. The "short-term," "intermediate," and "long-term" solutions each have profound effects on the availability of resources and ultimately on the patient care environment.

Three levels of response are identified as strategies that can be applied to each patient care service depending on the response timeframe and design risk category assigned to the building systems that support it. Requirements for adherence to these guidelines must be identified in the organization's disaster, emergency, and vulnerability assessment.

An Excel file of this compliance matrix can be downloaded from the FGI website.

- After the selection of a location for an ACS, the organization could also use the matrix to streamline the process of working with the local AHJ to implement any structural improvements needed at the location.
- If an emergency event continues long enough to extend the need for the alternate care site beyond the general timeframes described, the organization could continue to use the matrix in tandem with AHJ consultation to implement any further upgrades needed to attain full compliance.

Moving an ACS to full code compliance

When an organization decides to continue using an ACS after an emergency event, perhaps making it a permanent health care occupancy, it is important to remember the building will have to be brought into full code compliance.

As indicated in the ACS hierarchy of needs (Figure 3-1), the health care organization's goal is to work toward full code compliance over time. That progression doesn't necessarily happen steadily, though. The reality is that not all ACSs can be made code-compliant, regardless of the timeframe.

During the COVID-19 pandemic, provisions that were intended for brief use were often employed for an extended period. This is why it is critical to keep the potential length of use in mind when selecting an alternate care site; the longer an emergency event continues, the more important it is for the ACS to provide not only basic shelter, safety, and utilities, but also the minimum clearances, infection prevention controls, and other design elements and support services required by the *Guidelines* documents and AHJs.

As structures remain in use, organizations can continue upgrading them toward compliance. This can be achieved through operational strategies, such as diverting patients to other sites, or through construction of progressively more compliant facilities. For instance, after a tornado hit Joplin, Missouri, in 2011, Mercy Hospital saw a progression from immediate deployment of a tent to Butler

buildings within a couple of weeks, followed by a modular hospital a few months later, and finally a newly constructed, conventionally built hospital nearly three years after the tornado. Each step in the progression of alternate care sites brought the Mercy facilities closer to full code compliance.

General Considerations for Space Planning and Surfaces

The anticipated uses and time required for preparation of an ACS will directly affect space planning efforts and decisions about surface materials to be used at the site. Architectural materials should be chosen with consideration for their anticipated length of use along with the required speed of site preparation. Materials that support proper infection prevention practices should be determined at the beginning of this process, followed by any other needed materials that are readily available for the project.

The FGI *Guidelines* specifies minimum room sizes, clearances around patient care spaces and equipment, adjacencies, and corridor widths. Any ACS intended for immediate use (e.g., a tent or Butler building) is unlikely to be able to provide all of the programmatic requirements of a code-compliant health care facility. For this reason, life safety egress concerns should govern the minimum widths and lengths of corridors and door widths in these alternate care sites. Other size and dimensional requirements may be relaxed in facilities for short-term use, strictly during emergencies. In all cases, especially where standard spatial requirements cannot be met at the ACS, the health care organization should consult with both clinical staff and the local AHJ to make sure sufficient space is provided for safe provision of care. Generally, the longer an ACS is anticipated for use, the closer its spaces and materials should be to full compliance with the FGI *Guidelines*. Similarly, the higher the level of clinical services and acuity of patients in the ACS, the greater the need for compliance with the *Guidelines*.

An ACS should be laid out to optimize operational efficiency, accommodating patient and staff needs as well as storage and use of all supplies and equipment. For example, travel distances for patient care providers should be as short as possible, and whenever possible an unobstructed line of sight from nurse stations to patient care areas should be provided.

Specific architectural considerations for alternate care sites include these:

- Surface materials should be easily cleanable and as monolithic as possible.
- Transitions between materials should comply with flame-spread and smoke-developed limitations as required by applicable life safety codes.
- Flooring should be nonslip and smooth.
- Thresholds between different materials should be selected for easy movement of beds and other equipment.
- Where any glass is used, it should comply with building code requirements relevant to the location.
- Where clear plastic is used, it should have appropriate smoke-developed documentation.
- Designs promoting patient privacy and on-site noise reduction should be considered wherever feasible and conducive to increased patient/staff safety.

General Considerations for Building Systems

The recommendations in this section establish minimum criteria for mechanical, electrical, and plumbing (MEP); fire protection; and information technology systems that will be provided at an ACS. Considering these recommendations may also help health care organizations select an ACS without compromising the basic system design risk categories outlined in NFPA 99: *Health Care*

Facilities Code. Ventilation provisions will vary based on the type of emergency event and level of patient care provided and are therefore addressed separately from other building systems.

When advancing from one set of these timeframe-specific recommendations to the next (e.g., when an emergency event calling for an "immediate response" necessitates a "temporary response"), the recommended criteria from all preceding timeframes should be maintained. For example, it is expected that a site selected for an intermediate duration will also meet all of the considerations for the immediate and temporary response stages.

Immediate Response Building System Criteria

Alternate care sites deployed for immediate response to an emergency event include facilities such as open-air tents, arenas, and convention centers. Means and methods needed to maintain building system operations should be implemented in such ACSs. Primary considerations are:

- **Communication and information technology systems.** Assuring communication is possible between the ACS and parent health care facility is a high priority. A designated emergency operations team should define plans for providing backup and off-site systems in the health care organization's emergency operations plan.
- **Portable generators or other power sources.** Provision of emergency power is essential, including space for fuel storage.
- **Water and sewer provisions.** These must be appropriate for the system used, which may be selected based on what is available. Provisions for portable hand-washing stations and remote sanitation stations may be included.
- **Mechanical, electrical, medical gas, and fire protection systems.** Mechanical, electrical, medical gas, and fire alarm and protection systems may not be available in an immediate response situation. AHJs are generally understanding of such situations and will work with the emergency operations team to identify safe and manageable services appropriate for the

given emergency event. Where portable medical gases will be used, provisions must be made for their safe storage when not in use. Additional space may be needed in patient care stations to support the use of portable medical gas systems.

Utility Considerations for an Immediate Response

Provision of the following general utility elements should be considered for an immediate emergency response:

- Portable generators
- Water/sewer needs
- Ventilation/heating/cooling
- Internal/external communications
- Fuel
- Medical gas
- Opportunity for temporary sterilization
- Coordination of supply chain needs

Temporary Response Criteria

The utility systems for a temporary ACS (e.g., Butler buildings, mobile/transportable medical units) could be provided as an extension of normal services from an existing facility or generated on-site using equipment that can be replenished or removed without system downtime. On-site storage may be needed to support the continuous operation of essential utility systems. The configuration and reliability of each utility system should comply with the risk categories defined in NFPA 99 relevant to the patient care services being provided.

- **MEP and fire protection systems.** MEP and fire alarm and protection systems should be selected based on system

availability and the types of patient care being provided. Semi-permanent connections should be available for water and sewer access. Equipment system types, material types, and installation methods should be selected and installed to meet the intent of the design risk categories outlined in NFPA 99 and *Life Safety Code* requirements.

- **Facility fire suppression and fire alarm notification.** A temporary ACS should have readily available fire extinguishers or a hard-wired fire and smoke detection system with an integral notification system. Trained facility personnel should be available for "fire rounds" while the facility is occupied.
- **System efficiency standards and energy code compliance.** Based on the availability of equipment, utilities, and site conditions, temporary systems should comply with applicable energy codes to the greatest extent possible. Because the primary focus of these systems is to meet the needs of the emergency response and conditions, meeting full compliance criteria may not be feasible.

Intermediate Response Criteria

Services supporting an ACS deployed for an intermediate duration (e.g., modular units; converted hotels, dormitories, prisons) should be provided by a public or private utility system, an extension of services from an existing facility, or on-site generation and storage equipment that can be replenished and removed without system downtime. The configuration and reliability of each system should meet the intent of NFPA 99 per the patient care services being provided.

- **Facility fire suppression and fire alarm notification.** The ACS should have readily available fire extinguishers and a hard-wired fire and smoke detection system with an integral notification system. Along with providing on-site fire detection, suppression, and notification to building occupants, the system should be monitored by external first responder agencies. The permanent or temporary water and

electric systems used to support all fire systems should be fully functional and capable of responding to a fire or smoke event.

- **System efficiency standards and energy code compliance.** Systems in an intermediate-response ACS should be designed so they can remain in place if the facility is eventually converted to permanent use or otherwise repurposed once it is no longer being used to address the original emergency event. As such, systems in this context should be designed to comply with applicable energy codes, although making it possible to disable economizer controls during an emergency should be considered.
- **Conversion of intermediate response to permanent response.** Any facility that is going to be converted from an intermediate response use to permanent use should be designed and constructed in accordance with all applicable codes.

Permanent Response Criteria

All systems and equipment serving a facility that is designed to be a permanent health or residential care facility (e.g., custom modular buildings, new construction) must be designed and constructed in accordance with all applicable codes.

Ventilation Systems

Ventilation needs will vary based on the nature of the emergency situation and level of care needed by patients. During emergency situations that present minimal risk of infectious disease, the ventilation systems provided will closely mirror those described in the timeframe-oriented recommendations outlined above. In emergency situations that involve an elevated risk of infectious or potentially infectious disease, both "immediate" and "temporary" response ACS facilities should provide ventilation systems that reduce the potential for spread of infection. In some cases, the most appropriate response may be to conduct immediate response operations in open-air or open-sided membrane structures to

allow for dilution of the air through natural ventilation. In general, organizations are advised to refer to ANSI/ASHRAE/ASHE Standard 170: *Ventilation of Health Care Facilities* when considering ventilation provisions.

When evaluating ACS ventilation systems for a potential emergency event where infectious agents may transmit through aerosols or droplets, consider the need to:

- Dilute infectious aerosols through outdoor air ventilation.
- Remove infectious agents through local exhaust, HEPA filtration, or proven air disinfection methods (i.e., ultraviolet germicidal irradiation).
- Prevent cross-contamination through patient isolation (e.g., providing a private room with the door closed or an airborne infection isolation [AII] room).
- Maintain pressure differentials between spaces (e.g., an AII room, negative pressure room).
- Maintain directional airflow patterns to protect non-infected patients from infected patients.
- Evaluate the potential for contamination of outdoor air by exhaust where air-handling systems use airside energy recovery.

Alternate Care Site Types

Numerous types of structures can be repurposed or altered to serve as an alternate care site, and each option has pros and cons. In general, a structure's potential for adaptation is one of the key determinants of its usefulness during an emergency event. For example, tent structures may be quickly deployed and relocated as needed, but they can present significant limitations during emergency events of longer duration. In these situations, use of spaces in existing buildings (including non-health care facilities and decommissioned health care facilities) may be preferable.

Modular buildings provide an excellent long-term solution, but while they are generally completed faster than traditional stick-built construction, they will likely require more time to activate than tents or repurposed structures.

Common drawbacks of many emergency response solutions may include supply chain disruptions, unsatisfactory performance due to extreme weather, detrimental preexisting facility conditions, inappropriate ventilation and filtration, difficulty maintaining a clean-to-dirty workflow, inadequate support spaces, and suboptimal layouts that could lead to inefficient processes and unsatisfactory health outcomes. While immediate and temporary ACS solutions may be needed in some circumstances, most are not suited for long-term operation.

Tents (Membrane Structures)

These structures are among the most flexible solutions in terms of cost, time, and siting. Membrane structures have been successfully used around the world by emergency aid organizations, and there is an abundance of guidance on usage and best practices.[7] However, these structures are generally the least conducive to caring for high-acuity patients and fulfilling normal expectations for comfort and privacy. Also, membrane structures can be challenging to operate in poor weather conditions and provide little in the way of infrastructure and support services. Nevertheless, because they are the fastest and often least expensive to construct, they are viable solutions for short term-temporary solutions of less than 60 days.

Repurposed Structures

Repurposing existing structures is another expedient option for deploying an ACS. Moving patients to existing structures offers the advantage of speed because these facilities provide ready protection from the elements and basic infrastructure needs (e.g., running water, plumbing, electricity, HVAC, and possibly elevators).

Structures with multiple rooms

For patients or long-term care residents needing little observation, dormitories, barracks, and hotels may be a viable option. These facility types are usually designed to be center-loaded and often have segregated HVAC systems as well as sleeping rooms that are separated from public corridors as required for both health and residential care facilities. However, the ventilation (e.g., PTAC systems) and finishes in the rooms are unlikely to comply with infection prevention protocols.

These facilities should be able to accommodate high power loads and are likely to have large open spaces (e.g., ballrooms or meeting rooms), food and janitorial support services, and an automatic sprinkler system. Schools and community centers should be considered by rural communities lacking access to hotels, convention centers, or regional health care facilities. Jails and prisons could be suitable for converting to an ACS in certain circumstances, although particular care would be needed during planning to assure the safety of all populations accessing the facility.

Large-span structures

Structures like arenas and convention centers provide large open areas that can be configured to meet patient care needs relatively easily and are also likely to feature emergency power and fire protection systems. However, some special considerations must be addressed when these structures are used to provide patient care. Examples include accommodations for patient privacy, reduction of interior noise levels, optimization of flooring material where possible, and location of nurse stations near utility access points.

Repurposed health care facilities

In some emergency conditions, it may be preferable to repurpose and reopen a health care structure that was previously closed down. When this ACS solution is utilized, careful attention should be given to returning building systems to good operating conditions via flushing and testing processes.

Modular Facilities

Modular buildings are excellent long-term solutions that can comply with most codes. Because they can be put into service in as little as two to three months, they are ideal solutions for intermediate duration emergency responses as previously discussed in this chapter. Modular construction is defined here as a process in which a building is constructed off-site, under controlled plant conditions, using the same materials and designing to the same codes and standards as conventionally built facilities. Emergency modules would typically be constructed in a location that has not been affected by the emergency event. Modular buildings can be constructed while a site is being prepared, saving considerable time and expediting the completion of an ACS module.

Modular facilities can be designed to meet most, if not all, of the requirements of the FGI *Guidelines,* and therefore can provide a higher quality healing environment. Because the exact nature of an emergency condition cannot be ascertained until the event occurs, it is difficult to fabricate and inventory a complete modular solution ahead of time. This disadvantage applies to stick-built construction as well. While AHJs can make accommodations in the review process to allow for rapid deployment of modular solutions, such concessions increase risks for the health care organization, modular solution provider, AHJ, and patients and staff.

To reduce the amount of time required to design and construct modules during a public health emergency, a primary goal of this subcommittee was to provide recommendations for designing prototypes for medical-specific modules that can be preapproved by AHJs for emergency use. Having these modules preapproved by licensing authorities facilitates a quick scale-up in production when needed (see "Modular prototypes and approval process" later in this chapter). The creation of modular prototypes for health care use would help negate the primary disadvantage of modular construction—the time required for design, fabrication, transportation, installation, and approval.

Application of General Considerations to Specific Facility Types

The general considerations for choosing, designing, and deploying alternate care sites described above are discussed in this section as they apply to each ACS facility type.

Tents (Membrane Structures)

Tent structures are best used where quick but temporary deployment is necessary. As indicated in the compliance assessment matrix, the use of tents should be limited to the short term and for groups I and II. Tents provide basic shelter and are not typically appropriate for either long-term use or medically complex patients. Short time frames and relatively stable patients are the best uses of tents. Locations subject to hurricanes, tropical storms, or winter storms and generally cold winters make using tents very challenging. The difficulty in maintaining specific air changes and pressure relationships makes tents less than desirable for invasive procedures. The open nature of tents allows power, data, and fire alarm systems to be installed overhead relatively easily. It is strongly suggested that AHJs be involved in the review of tent structures and aware of their temporary nature.

As illustrated in the Manati, Puerto Rico, case study in Appendix 3-4, local climate and time of year will determine the suitability of a tent as an emergency structure. Areas typically subject to hurricanes and tropical storms should use tents as a last resort during hurricane season. Siting of tents on flat but drainable grade is critical. In areas where temperatures and potential snow loads present a challenge, tents should not be used during winter months. While tents can handle large numbers of beds, the larger the site the more planning issues—from travel distances to pumping wastewater from sinks—become important to consider. Although a tent's open nature allows for quick construction, the case study shows that MEP and life safety concerns can be addressed with additional construction and coordination.

Tents can take up a great deal of space, so deployment should be planned carefully. The site should be flat and, because tents typically have open floors, the type of floor construction and material to be used must be carefully considered. Water infiltration is a huge concern, which must be mitigated to prevent flooding or penetration of the tent interior. Site drainage is a critical issue for locating a tent. Site utilities such as power and lighting can be handled via a portable generator. Water (hot, cold, hand-washing, potable, etc.) can be provided in a tent with portable tanks, water trucks, or connections to existing facilities. Local pumps may be required due to difficultly in sloping drainage below the floor. Toilet facilities would have to be portable with a routine pumping service. All of these issues need to be addressed with careful planning. Parking lots and football or soccer fields may be suitable locations. Tents should only be used for immediate response preparation of short duration and only as temporary facilities (up to 60 days).

Tent membrane material should be non-combustible or limited combustible structures or fire/flame retardant that conforms to NFPA 701: *Standard Methods of Fire Tests for Flame Propagation of Textiles and Films*. Floor and wall surfaces should be smooth, cleanable, washable for disinfection, and nonporous. Seams and crevices should be minimized. If provided, wall and ceiling finishes should meet class A rating.

MEP systems

Mechanical, electrical, and plumbing systems for tents can be provided under an elevated floor system or suspended from above and connected to independent supports or the tent structure.

Mechanical systems

Independent mechanical systems will need to be installed to provide conditioned or temperate air in the tent depending on the region and time of year. Quantity and placement of this equipment must be thoroughly evaluated to minimize hot or cold spots. Temperatures may be difficult to maintain due to the tent envelope, environment, and outside conditions.

Electrical system

An electrical system for power and lighting to comply with national/state/municipal codes such as NFPA 70: *National Electrical Code*, NFPA 99, and NFPA 110: *Standard for Emergency and Standby Power Systems* must be provided. Use of portable generators on a flatbed or pad-mounted generators is the most realistic way to achieve this for tents unless connection to an existing facility is possible. Plan for continuous operation for 24 hours before refueling is needed.

Plumbing systems

- **Water and sewer.** Water and sanitary services should be provided in accordance with the *International Plumbing Code*. Included are a piped sanitary vent to the exterior, sanitary collection tank, and lift stations as needed to pump waste. The collection tank could be pumped out on a weekly cycle or connected to a local sanitary sewer system.
- **Medical gas.** Medical gas can be handled using portable bottles, which would require a hazardous storage area for full and empty tanks. If higher demands or more critical patient treatment is necessary, then a piped medical gas system may be more appropriate. Piped systems must comply with NFPA 99 and have a bulk oxygen tank with vaporizer. Given the nature of a tent, most AHJs will likely require a rated enclosure or at minimum a rated wall outside the tent to separate it from medical gas storage.

MEP for fire alarm and fire protection

Overhead wiring can be used to provide a fire alarm system in a tent. Sprinkler systems are more challenging, but use of a standpipe system may be a reasonable compromise. Fire watch might be acceptable, but it is an operational cost. These options should be reviewed with the AHJ.

Information technology/communication

Tents do not have the infrastructure to support technology components found in a hospital or health care setting. However, their open nature means a variety of alternate solutions is possible. Communication can be conducted via walkie-talkies between staff, infant monitors for patients, and frequent rounding (at 5-, 10-, or 15-minute intervals). Wi-Fi can be provided by hot spots, cell phones, or temporary satellite access. Cell phones and/or tablets could be used for communication, linking to the local hospital network for record-keeping. Users may have to seek off-the-shelf solutions such as cameras with two-way calling or phones with open conference lines as a means of observation and communication when traditional means are stretched thin or unavailable.

Medical equipment and supplies

Basic medical equipment and supplies needed to provide effective patient care operations may include the following: PPE for staff, hand sanitizer, gloves, sharps, patient beds, portable headwalls, medication-dispensing unit, portable oxygen tanks or piped system, soiled linen containers, clean linen, bio-waste disposal, portable ice machine, crash cart, automated external defibrillator, stretcher, wheelchair(s), blanket warmer, and portable x-ray. Environmental services supplies for cleaning and disinfection must also be easily available. Medical equipment in a tent would likely be portable and thus storage and tracking could be a concern. The anticipated acuity of the patients to be served should determine any additional equipment beyond the basics.

Structures with Individual Rooms

Potential alternate care sites with multiple spaces include smaller facilities such as hotels, dormitories, schools, and prisons and larger open facilities such as convention centers. The “hotel to hospital” case study in Appendix 3-5 explores this ACS solution in the context of a hospital setting. Each of the individual-room facility types has advantages and drawbacks, which can be evaluated using the compliance assessment matrix shown in Figure 3-4.

Infrastructure considerations

Key aspects of these facilities to evaluate for use as an ACS are accessibility and life safety, transport and movement within the facility, and MEP infrastructure.

Existing infrastructure

- Individual-room type facilities have the advantage of privacy and smaller individual patient rooms, but this segregation creates limited lines of site, which can make it difficult for medical staff to care for multiple patients efficiently.
- Long corridors may create accessibility and life safety issues that need to be addressed through physical modifications or adaptation of medical care functions to meet the intent of code requirements. Facilities with long, narrow corridors, such as hotels and dormitories, make patient transport in the facility difficult.
- MEP infrastructure is typically provided (e.g., a bathroom in each room), but PTAC units in hotels and similar facilities have serious ventilation deficiencies for health care occupancy (e.g., interior air is recirculated, manual controls could allow anyone to turn off ventilation completely, and humidity is not well controlled) that will need to be considered.
- Elevators may not be sized for patient and equipment transport. When elevators are not on emergency power in facilities such as high-rise hotels, this can quickly remove them from consideration unless temporary emergency power can be effectively added.
- One of the most important aspects in evaluating use of these different facility types is management of staff, equipment, and supplies. Most of these facilities are equipped with loading docks and the ability to handle incoming supplies and may have food service already on-site, which is a plus. If on-site food service is not available, it can be outsourced.

Infrastructure that will have to be added

Medical gases are a required infrastructure component for acute care patients in an alternate care site. Individual rooms will make adding piped gases difficult due to existing wall structures and limited space above and below the ceiling as is often the case in hotels and dormitories; schools and prisons are usually more accommodating. The physical limitations of hotels and dormitories require provision of limited medical gases via individual tanks, which introduces infection prevention issues because the tanks are recycled and require cleaning and disinfection, particularly for an infectious disease ACS.

Other pros and cons of different facility types

While some existing individual-room type facilities seem ideal as an ACS (e.g., nursing homes), unless they are already vacant using these facilities would require relocating patients, which can negatively affect patient health and prognosis.

Prisons, when available in their entirety or in part, have proven viable for short duration patient holding. The layout with segregation of the facility in pods works well, MEP infrastructure is existing and hardened, access control is available, egress is in place and adequate, and cleanliness can easily be maintained with air changes, concrete floors, and cleanable surfaces. Schools may serve in a similar way, but they do not have all these advantages fully developed and in place (e.g., most schools in the northern United States do not have air-conditioning).

Hotels may also be used for patient holding rather than acute care without significant modifications. However, their best use is for housing medical staff who travel to the area or local medical staff who prefer to stay close to the hospital due to travel time or to prevent exposure of their families in the case of an infectious disease. Using hotels in this way can free up hospital space for alternate care uses.

In summary, individual-space type ACSs are often best used for non-acute patient holding or temporary accommodations for medical staff.

Large-Span Structures

Large-span structures are defined here as any publicly or privately owned large-scale buildings or enclosed spaces connected to electrical and plumbing utilities that stand separately from a health care campus or hospital. These include facilities such as school auditoriums, convention centers, sporting arenas, hotels/motels, and enclosed concert venues. Health care providers may choose to use the space and utility access offered by such large-span structures in order to accommodate patient surges during any kind of emergency event.

The efficacy of large-span structures as spaces for medical care can be optimized through both careful planning and adaptive problem-solving during emergency events. Given the lack of formally established guidance on how health care providers should best utilize these spaces and the wide variability of large-span structures themselves, it is often necessary to enlist professional assistance in adapting such facilities for medical use. The McCormick Place case study in Appendix 3-6 examines this ACS solution in a convention center setting.

Operational considerations

Because large-span structures are not designed or equipped to support provision of emergency medical care, it is imperative that any health care providers overseeing equipment installation and distribution, on-site staffing, and patient treatment protocols in a large-span structure maintain clear and consistent channels of communication with local health care entities. Establishing and maintaining this relationship during emergency events can enhance care delivery across the board; the local health care entity should be able to help provide the human and technological resources required to temporarily use the structure as a health care space. This relationship can inform everything from effective delivery of pharmaceutical, laundry, food, or mortuary services to supply of needed medical equipment such as dialysis machines or portable operating rooms. As well, local health care entities will likely have existing processes for maintaining and recalling patient information, which can be crucial when operating from an alternate care site.

Communication with owners. It is important to establish and maintain a working relationship with the legal owners of a large-span structure being used for emergency care. In most cases, these building owners will have final jurisdiction over approving or rejecting any renovations or operational procedures that occur on the premises. By communicating transparently and consistently with property owners, legal and logistical complications both during and after an emergency may be avoided and valuable time towards patient care can be saved.

Patient populations. Different patient populations may significantly alter staff workflows, security protocols, equipment needs, and temporary structural decisions. For example, providing care to a population of incarcerated patients who have tested positive for COVID-19 would require different operational protocols (e.g., heightened security, physical distancing, PPE distribution, increased visibility between patients and staff) than caring for a surge of patients from the general population during a flooding event. If care is being provided to a sizable elderly population, dedicated caretakers and more specialized treatment regimens may be required. Even if advance knowledge of an incoming patient population is unavailable during a given emergency event, considering the social and operational contexts of any given patient population can help promote more effective care delivery.

Patient visibility. Large-span structures that permit good patient visibility, such as convention centers or auditoriums, may reduce overall demand for some staff because a smaller number of staff may be able to monitor multiple patients more easily than in more structurally segregated spaces like hotels. In the latter, more regimented scheduling and extra personnel may be needed to perform necessary rounds. At the same time, hotels may provide more adequate forms of ventilation, necessary patient isolation, and access to amenities such as laundry equipment. Given the pros and cons of each structural type, health care organizations must consider the needs of the specific patient population seeking care during any given emergency event and select the most appropriate large-span structure based on available information.

Wireless communications. Employing wireless technology for communication and monitoring purposes, where possible, can be highly beneficial when administering care in large-span structures. Smartphone applications that assist with recording and transmitting patient data are developing rapidly, along with other wireless technologies that allow for remote monitoring of a patient's physiological readings and the ability to foster remote patient/staff communication. In the case of a pandemic, using these technologies can improve patient and staff safety by mitigating exposure to infectious disease.

Infrastructure considerations

Among the most important infrastructure considerations in selecting and properly utilizing a large-span structure are the structure's flooring, its utility box access, and the condition of its HVAC system. The status of these three factors can significantly affect the tenability of a given large-span structure for the purpose of health care delivery. When these factors are inadequate or cannot be modified due to decree by the property's owner, it may be worthwhile to consider a different site.

Flooring

Wherever possible, carpeting should be removed. Carpet can trap dust and other allergens and impede effective movement of equipment. All concrete flooring should be sealed, and vinyl flooring should be considered as an additional overlay. Because making these flooring modifications can be time-consuming, structures that already have sealed concrete and/or vinyl floors may be preferable when advance consideration is possible.

Utility boxes

Many large-span structures, such as sporting arenas and convention centers, are equipped with underfloor utilities, while others such as school auditoriums may not be. Access points to these utilities will largely dictate where nurse stations and aboveground utility access points can be located. Because electrical power is an absolute imperative for adequate patient care, portable generators should

be considered in cases where utility box access is unavailable or unsuitable.

HVAC systems

In some cases, HVAC systems can dictate the feasibility of using a large-span structure as a clinical space. For instance, when treating patients affected by an infectious disease such as COVID-19, negative air pressure must be available.

Scaffolding

In many large-span structures, scaffolding or other overhead support structures may provide effective pathways for routing utility connections. In many convention centers or similar spaces, wiring can be draped overhead, reducing walkway obstructions and keeping important entrance and exit pathways clear for movement of personnel and equipment.

Lighting

Access to natural lighting, which is an important part of patient and staff well-being, can vary widely among large-span structures. Whenever possible, patients who require extended stays (longer than one to three days) in a large-span structure should be situated as close as possible to available natural lighting sources. Alternatively, wherever individual patient rooms are assigned or temporarily constructed, installation of naturally colored lights should be considered.

Future considerations

The use of large-span structures as alternate care sites often occurs during relatively unpredictable or unexpectedly large-scale emergency events, and little established guidance pertains to operating these sites as medical care centers. School gymnasiums could act as prototypes for testing different approaches to care delivery in large-span structures as they often meet a middle ground in terms of the spaces and services these structures can offer. In all cases, it is best to prepare in advance for potential use of a large-span structure

wherever possible and to actively utilize all available resources and best practices to enhance the efficacy of a structure identified as a location for care delivery during any emergency situation.

Repurposed and Reopened Health Care Facilities

It is important initially to identify and understand what the organization- and community-based drivers are for the ACS. If health care requirements are the driving factor, identify the level of patient care to be provided in the ACS and the number of beds needed as early as possible. If the type of facility to be used as the ACS is the driver, evaluate the appropriateness of it to support the acuity level of the patients. Not all facilities are appropriate for high-acuity, long-term patients; efforts should be made to treat lower acuity patients in the ACS. The SUNY Stony Brook case study in Appendix 3-7 examines this ACS solution in the context of a repurposed college campus space.

When repurposing a health care facility in a surge event, it is important to start by assessing the space for use. A multidisciplinary team will provide the most comprehensive evaluation as they have knowledge of practices in the field that will improve design of donning and doffing areas, triage spaces, nutrition transfer facilities, and so on. These teams should include facility management, security, infection prevention, nursing, and other medical staff or representatives of these groups. In addition, the team should include hospital support service expertise from the affiliated hospital.

Other stakeholders to bring into the repurposing effort include AHJs and the owner of the structure to be repurposed. Even though it is an emergency situation, local jurisdictions may have mandatory requirements that cannot be overlooked or have invaluable resources to contribute. Be sure to clearly and concisely document all communications. Negotiate up front with the owner for management/maintenance of the new occupancy, resulting in a letter of agreement. Before moving ahead, the health care organization looking to expand surge capacity must clearly understand the terms of the lease/purchase and the cost of using the proposed facility.

While billing and insurance may seem a low priority in an emergency, they can have significant ramifications in the use of the facility and the services offered. A local hospital should be identified, and hospital representatives should be named as primary stakeholders and included in planning, design, commissioning, and turnover activities. The ACS should be an extension of an established local health care system as it will meet CMS requirements for reimbursement and have established agreements with commercial health insurance plans.

Design and construction considerations

When determining whether to reuse a facility to meet an emergency need, the speed of conversion compared to the cost of modifications should be reviewed and prioritized accordingly. Establish what is appropriate to program in a new space to support the situation at the parent health care facility. Structures and systems at the repurposed facility need to be aligned with need; consider factors such as access to the facility and ease of controlling that access, environmental concerns (e.g., mold, asbestos), and potential building envelope issues as well as existing infrastructure capacity, reliability, and/or resiliency.

Egress, access, and fire protection provisions are always a priority and should be critiqued by the organization's safety officer as well as the AHJ. Facility management experts should evaluate all MEP systems to determine the level of compliance needed for each in an emergency use. Interiors and building materials should be carefully considered in regard to infection prevention and safety. Environmental services experts should be relied on to make recommendations on surface materials.

The compliance assessment matrix shown in Figure 3-4 can be applied to recommissioned and repurposed health care facilities being considered and used for emergency response. When using the matrix, consider the services to be provided in the repurposed structure. Ensure team members understand the timeline that will lead to successful implementation. The EOP incident commander will drive the initial request for space. Consider duration of stay and assume it will be one category longer. Evaluate if the suggested group

and associated recommendations align with your facility's emergency operations plan. Lastly, evaluate what modalities, patient care, and support spaces are required and what are only nice-to-haves.

Support services

Support services should also be considered when planning and using a repurposed building as an ACS.

Materials management

Key considerations include logistics for large deliveries; storage for large quantities of supplies; and linen management. The method for distribution of sterile and non-sterile supplies from storage to places where they will be used should be determined.

Clinical engineering staff should establish protocols for initial inspection of medical equipment upon delivery and before patient use as well as for ongoing maintenance of this equipment.

Waste management

Means for managing both regular and biohazardous waste must be determined, including how the tremendous amount of waste likely to be generated will be processed.

Decedent affairs and body-holding

Space for these functions, including refrigeration, should be included.

Security

Site security and access need to be part of the security risk assessment and examined as part of the initial site review. Control points should be clearly established for incoming patients, staff, concerned family members, members of the press, and volunteers.

Food services

For facilities that require food services, consideration should be given to where and how food will be prepared. Determine whether a commercial kitchen is available on-site or if food will be prepared remotely. If remotely, establish how food safety will be monitored. Review how food will be stored, both for dry and refrigerated products. Lastly, accommodations to feed staff in space separate from patients need to be provided.

Communication and information technology systems

Technology considerations are instrumental for converting spaces. It is vital to understand if the existing technology system provides adequate communication between staff and patients. Depending on the duration of stay, a full nurse call system may not be necessary. Communication with the parent facility will be necessary to obtain and update medical records. Storage areas may require access control and security cameras.

Building systems

While challenging, efforts should be made to comply with the requirements in ASHRAE 170 and ASHRAE Standard 188: *Legionellosis: Risk Management for Building Water Systems*.

HVAC needs for infection prevention purposes

Determine if spaces need to be converted to meet negative pressure requirements and if additional filtration is needed to prevent the spread of disease. If negative pressure requirements are required, exhaust air ductwork should be negative pressure to prevent leakage of contaminated air. ASHE provides guidance for converting spaces to negative pressure. Unitary equipment such as patient bed ventilator hoods could be considered. Life safety elements should be assessed, including building ventilation and appropriate fire protection (suppression and detection).

Medical gas and plumbing considerations

The use of piped or bottled medical gases should be considered for some surge events. If bottled gas is used, ensure quantities do not exceed 3,000 cubic feet in any one storage area.

Capacity evaluation of potable water supply and the sanitary system should be reviewed, especially regarding potential issues with stagnant water services.

Electrical needs

Backup power should be sufficient to ensure separation of systems to address patient care and safety; sustain patient care; power provisions for tempering building and maintaining required medical gases; power elevators for multistory buildings for patient evacuation; and power for negative pressurized exhaust systems. Ensure adequate lighting for anticipated tasks with easy-to-clean luminaires that are not detrimental to infection prevention.

Documentation of the conversion

Finally, documentation of the implementation of the conversion is necessary along with the recovery and any mitigation toward future, similar events. A clear understanding of the spaces and systems that need to be returned to "original condition" should be developed. Accreditation agencies will ask if all impacted spaces and systems have been returned to normal following the surge event.

Modular Buildings

Modular structures provide flexibility of design that makes them adaptable to many situations, including emergency conditions. Prefabricated modular structures can be particularly useful for infrastructure replacement projects at any time, including during an emergency condition.

Modular solutions for emergency conditions

Modular buildings have some advantages for use during an emergency situation. Unlike other ACS types, these structures can be built to meet the requirements of the FGI *Guidelines* and, therefore, provide a high-quality, code-compliant healing environment. Modular buildings can be created under controlled conditions in an off-site location unaffected by the emergency event and can be built during site preparation.

Depending on the desired turnaround time, one drawback to implementing a modular solution may be the time it takes to develop and install the structures. However, many construction companies, manufacturers, designers and state agencies are interested in designs for modular health care facilities and willing to review planned installations during non-emergency conditions to facilitate their quick deployment when emergencies arise. Development of a prototype design for a modular unit that can be conceptually approved by an AHJ can expedite the approval process when use of a modular structure is desired in an emergency situation.

In developing such a prototype, health care organizations can use their DEVA and the compliance assessment matrix to arrive at a design that meets their anticipated needs. For example, one application of this approach would be to address the need for long-term isolation rooms for senior housing residents during flu season. A ready-to-implement modular solution for these spaces could greatly improve health care options every year or when the next pandemic hits. In some instances, state and other government agencies may choose to develop prototypes for modular health care solutions.

See the sidebar for a discussion of processes for seeking AHJ approval for a modular prototype before an emergency condition arises.

Modular Prototypes and Approval Process

Once a prototype modular solution has been developed for deployment during an emergency condition, the next step is to seek preapproval from the AHJ (e.g., state department of health) for its use. The prototype would not be approved for clinical use in non-emergency conditions unless it fully complies with FGI *Guidelines* or other AHJ requirements.

Following is a course of action for developing and seeking approval of a modular health care solution prototype:

- The prototype is developed and submitted to the AHJ during normal, non-emergency conditions. Once approved, it can be included as part of a mandatory risk assessment submitted to the AHJ on a regular basis or included with the organization's emergency operations plan.
- In states where the AHJ is the department of health, the following processes should be implemented:
  - An emergency filing process should be developed that requires identification of all code deviations.
  - An expedited approval process should be developed to enable rapid delivery of preapproved prototyped modular solutions. This expedited process will accommodate any customizations to the approved layout needed at the time of a specific emergency.
  - Leniency could be afforded by AHJs as long as the prototype solution complies with the compliance assessment matrix and identified needs in the health care organization's disaster, emergency, and vulnerability assessment.
- Where the state (not the department of health) approves modular construction for materials, fireproofing, surfaces, door sizes, etc., a parallel state preapproval process should be in place.

This approval process is envisioned in two parts:

- **Submission of the prototype preapproval package.** When submitting a modular unit prototype to the AHJ, the submission should include a drawing or set of drawings and

other relevant information to allow for comprehensive review. The prototype package should also include a demonstration of the minimum code compliance requirements for the timeline (short-term—immediate, short-term—temporary, intermediate, long-term), with deviations from code compliance noted. It should be conveyed to the AHJ that the prototype submittal package may not be able to indicate actual placement of the structure at the site. Therefore, site-specific details may be required as part of an expedited application for emergency use. The objective of the prototype package is to gain AHJ approval of the prototype module well before an emergency is anticipated, thus enabling quick review and approval during an emergency event.

- **Site-specific application (to be submitted during an emergency event).** When an emergency is declared and an organization wants to deploy a preapproved prototype module, a site-specific application must be submitted to the AHJ for emergency, expedited approval. The application should include:
  - Documentation showing preapproval by the AHJ
  - A drawing or set of drawings showing all relevant site-specific details and information
  - Proposed customizations for the modular structure to meet the intended use
  - A demonstration that the minimum compliance requirements for the expected timeline for use have been met, with deviations from code compliance noted.

The objective is to provide the AHJ with site-specific details and program customizations for consideration to achieve an expediated review and, ultimately, approval.

Once a modular solution has served its purpose during an emergency event, it can be stored for future use during emergency situations or repurposed for uses during normal conditions that are appropriate for its compliance level. Unless the prototype is constructed in full compliance with all applicable building codes, its clinical use will not be allowed during non-emergency conditions.

Three examples of modular solutions deployed during emergency conditions demonstrate how these structures can function:

- **Tornado.** On May 22, 2011, an EF-5 tornado tore through Joplin, Missouri, devastating the city and destroying Mercy Hospital. Mercy had 183 patients when the tornado hit, but the hospital had to be abandoned immediately after the event because the building could no longer support safe patient care. Immediate care was provided in any space available, including cots and open beds of pickup trucks.

  This initial solution was quickly followed by use of a short-term, self-supported field hospital (i.e., tents). Next, the hospital moved into portable buildings of a generic nature that provided more protection and support than the tents. While these portable structures were in use, the design team developed a modular medical center that served the community until a replacement hospital could be built.
- **Pandemic.** In the early months of the COVID-19 pandemic, when Albany, Georgia, was deemed a "hot spot," the Georgia Emergency Management and Homeland Security Agency commissioned a modular hospital to address the anticipated surge. Using shipping containers, a 96-bed hospital was constructed in four weeks and opened in eight weeks (Appendix 3-1). Another example of modular solutions, employed during the pandemic in Maryland and Georgia, is a temporary acuity-adaptable, prefabricated, self-sufficient, and expandable modular intensive care unit.
- **Hurricane.** A comparable modular solution was implemented after Hurricane Maria struck the Caribbean islands of St. Croix, Dominica, and Puerto Rico in September 2017. The Category 5 hurricane decimated St. Croix's Charles Harwood Hospital, which was condemned shortly afterward. The U.S. Army Corps of Engineers commissioned a 40,000-square-foot, 66-module facility that incorporated imaginative solutions to resolve difficult issues, including no available water source. This solution illustrates the benefits of having guidelines for design and construction requirements, which

the solution would have benefited from, but the resulting structure still served an immediate need and remains in use as of October 2020 (Appendix 3-2).

Considerations for implementing a modular solution

Discussed here are several factors that can influence the success of a modular solution in providing needed health care spaces during an emergency.

Site preparation

Preparation for installation of a modular structure includes locating and preparing a site for water, electricity, natural gas, and sanitary sewer connections, then contracting for installation of a modular solution as soon as an emergency condition is known.

Duration

When considering fully code-compliant solutions, the key benefit of volumetric modular construction is speed to completion when compared to conventional construction. In terms of duration, modular facilities make the most sense when full compliance is required and/or desired for use in the intermediate or long term; however, they can still be useful for an immediate temporary response, for which full compliance is not required or necessary.

Dimensional constraints

The need to transport a modular building to the site where it will be constructed introduces specific constraints that may limit the use of this solution during an emergency. Transportation costs are significantly greater for modular solutions with a height over 12 feet or width over 14 feet. A 12-foot height constraint makes it difficult to achieve finished ceiling heights above 9 feet. While this works well for most patient care areas and some treatment areas, it may present challenges for surgery, imaging, or other spaces that require taller ceilings, although it is unlikely temporary modular surgery or imaging spaces will be constructed in response to an emergency.

Mobile/transportable medical units may be an alternative solution for imaging facilities.

Despite these constraints, it is possible for a modular solution to be designed so that multiple modules can be connected together, at the site, to form a complete building that supports efficient, effective, and safe health care for both patients and staff.

Site utilities

Another important consideration for any modular solution (and most alternate care sites) is the need for an early evaluation of the site, including where the facility will be placed, utility needs of the planned facility and what existing utilities are available, proximity to support services, and emergency services access, among other details. This early evaluation of the site will allow for analysis of both cost and time for implementing the modular solution and appropriate development of the site. The location and elevation of the connection to the sanitary waste utility is critical because the elevations of the piping will affect the layout of the modular building.

Modular solutions may be manufactured to minimize the need for utility connections by providing their own generators, medical gas systems, water tanks, and sanitary holding systems. However, this can drive up costs, so most modular solutions have an option for connecting to site utilities.

Alternate Care Sites Fill a Need

When a health or residential care organization anticipates an emergency situation, deploying an alternate care site to address patient needs may be the most expedient option. Although not perfect, an ACS can be an effective solution when resource sharing on a local, regional, national, or global level is limited; when surging into unused and repurposed areas in a facility won't yield enough space to deliver patient care to all who need it; and when stopping elective and non-urgent services won't free up enough resources to meet the emergency demand.

A health or residential care organization's emergency operations plan should clearly identify how the organization expects to respond during an emergency situation and may include provisions for possible deployment to an ACS.

The organization must review its EOP annually to assure it is up-to-date and the organization remains prepared for various types of emergencies. Identifying viable sites for alternate care facility types in an EOP assures that deployment to an ACS is in line with the organization's emergency preparedness efforts. This information should also be assessed annually as conditions, including ownership, of selected sites may change. The goal of these efforts is to reduce the likelihood that an organization will be forced into an improvisational emergency response.

Planning of this scale requires effective collaboration between the health or residential care organization, the community, design professionals, contractors, accrediting organizations, and AHJs. Together, they must assess—in the context of likely threats and attendant circumstances—potential ACSs and the plans required to assure these facilities are able to maintain the standard of care and provide a safe physical environment for patients and staff.

Resources such as the compliance assessment matrix in Figure 3-4 provide organizations and AHJs with tools to plan for and determine the resources necessary to make an ACS operational. Depending on an emergency event and its duration, the requirements for and care provided in an ACS may evolve, but the goal should always be to resume normal operations and return patient care and other services to fully compliant spaces as quickly as possible.

Providing emergency care in facilities that were not designed for health care services will undoubtedly require some temporary concessions in code requirements. While AHJs may be willing to make accommodations in the review process to expedite the use of alternate care sites, such concessions may increase risks for the health care organization, designer, constructor, alternate site owner, AHJ, patients, and staff. Identifying and quantifying

an organization's risk tolerance and assuring a reasonable level of patient safety when using ACS facilities are key.

Organizations would be wise to consider possible alternate care site scenarios long before an emergency threatens. Assuring that an ACS is consistent with the organization's EOP, fulfills the needs of patients and staff, and is capable of meeting desired implementation and operational timeframes will facilitate decision-making and enable quick action when facing an emergency event.

Resources

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Endnotes

1 Centers for Disease Control and Prevention definition: "a broad term for any building or structure of opportunity that is temporarily converted for health care use during a public health emergency to provide additional health capacity and capability for an affected community, outside the walls of a traditional established health care institution."

2 American Society for Health Care Engineering definition: "any building or structure not currently being used for health care that is temporarily converted or constructed for health care use during an urgent need in capacity to provide additional capability for an affected community, outside the walls of a health care facility.... An ACS includes spaces such as, but not limited to: hotels, arenas, barracks and dorms, tents, closed hospitals, and modular units. ACS does not include the conversion of non-patient care space within the walls of a current hospital converted for use during a surge event, nor does it include equipment stored and ready for deployment in a site outside of the walls of a current hospital."

3 U.S. Army Corps of Engineers definition: "a facility that's temporarily converted for health care use during a public health emergency to reduce the burden on hospitals and established medical facilities."

4 For more information on mass casualty incident levels, see FEMA's *Operational Templates and Guidance for EMS Mass Incident Deployment*, https://www.usfa.fema.gov/downloads/pdf/publications/templates_guidance_ems_mass_incident_deployment.pdf. (Accessed September 26, 2020.)

5 Federal Healthcare Resilience Task Force, Alternate Care Site Toolkit, http://alternatecaresiteplanning.com/wp-content/uploads/2020/07/acs-toolkit-Third-Edition.pdf. (Accessed Jan. 11, 2021.)

6 Other documents and organizations describe processes for developing emergency operations plans (EOPs). For detailed information on EOPs and safety risk assessments, see the risk assessment chapter in this white paper.

7 An excellent resource on medical guidance and operational considerations for alternate care sites is the Federal Healthcare Resilience Task Force's Alternate Care Site Toolkit, available at http://alternatecaresiteplanning.com/wp-content/uploads/2020/07/acs-toolkit-Third-Edition.pdf. (Accessed Sept. 22, 2020.)

Proposed Language Based on the 2018 Hospital *Guidelines* from the Modular Construction Subcommittee

The proposed new language below shows changes to the 2018 FGI *Guidelines* recommended by the modular construction subcommittee of the Emergency Conditions Committee. Additions are underlined, and deletions indicated with a ~~strikethrough~~. Where an appendix item (i.e., a non-enforceable recommendation or guidance on applying a requirement) has been provided, an asterisk (*) precedes the section number (e.g., *1.2-4 Safety Risk Assessment). Appendix items can be identified by the letter "A" that precedes the correlating section number (e.g., A1.2-4 SRA). The text shown has been excerpted from the 2018 *Guidelines* and is not comprehensive. These proposed changes have been adapted and incorporated with recommended changes from other subcommittees in the draft *Guidelines for Emergency Conditions in Health and Residential Care Facilities* in the last section of this white paper.

Chapter 2.8, Mobile/Transportable Medical Units

2.8-1.1.1.~~2~~3 ~~This~~ The requirements of this chapter shall not be applied to federally funded mobile/transportable medical units designed for and placed into service ~~as a result of~~ to respond to a civil or local emergency or catastrophe.

***2.8-1.1.1.~~3~~4** This chapter shall not be applied to modular/relocatable medical units that are prefabricated off-site and finished on-site and transported to a permanent foundation. ~~on-site that cannot be readily moved.~~

Proposed Language Based on the 2018 Hospital *Guidelines* from the Alternate Care Sites Subcommittee

The proposed new language below shows changes to the 2018 FGI *Guidelines* recommended by the alternate care sites subcommittee of the Emergency Conditions Committee. Additions are underlined, and deletions indicated with a ~~strikethrough~~. Where an appendix item (i.e., a non-enforceable recommendation or guidance on applying a requirement) has been provided, an asterisk (*) precedes the section number (e.g., *1.2-4 Safety Risk Assessment). Appendix items can be identified by the letter "A" that precedes the correlating section number (e.g., A1.2-4 SRA). The text shown has been excerpted from the 2018 *Guidelines* and is not comprehensive. These proposed changes have been adapted and incorporated with recommended changes from other subcommittees in the draft *Guidelines for Emergency Conditions in Health and Residential Care Facilities* in the last section of this white paper.

Chapter 1.2, Planning, Design, Construction, and Commissioning

1.2-6.5 Emergency Preparedness and Management

During project planning and design, the following shall be considered:

***1.2-6.5.1** The likelihood that a facility will experience events that go beyond a facility's normal operations

> **A1.2-6.5.1 Emergency preparedness assessment.** The likelihood that a facility will experience events that go beyond normal operations should be assessed and detailed in an annual emergency preparedness assessment. These

events could include natural disasters; utility failures; acts or threats of human violence; biological, nuclear or chemical exposures; surge capacity; evacuation; and mass casualties.

a. *Infrastructure assessment.* The assessment should consider performance of structural and critical nonstructural building systems during an adverse event and the likelihood of loss of externally supplied power, gas, water, and communications from such a disaster.

b. *Hospital facility planning.* Ideally, the emergency preparedness assessment results will be used to implement practices and plans that will help the health care organization prevent, mitigate, and expediently recover from an event. Hospital facility master planning should consider mitigation measures required to address conditions that may be hazardous to patients and conditions that may compromise the ability of the hospital to fulfill its planned post-emergency medical response.

Resiliency requires a plan to absorb and recover from adverse events by preparing, preventing, protecting, mitigating, and responding. The emergency operations plan should outline a hospital's ability through mitigation and planning to:

—Handle patient influx due to a public health emergency or mass casualty event.

—Coordinate and communicate effectively with community partners.

—Adapt to changing conditions.

—Recover from disruptions.

—Resist probable deliberate attacks.

—Improve technical and organizational capabilities.

—Focus on reducing damage and disruptions to public health and safety.

***1.2-6.5.2** Space needs in the event of an emergency for operations to:

1.2-6.5.2.1 Protect facility occupants during the event.

***1.2-6.5.2.2** Continue providing services as outlined in the facility's emergency operations plan (EOP).

Proposed Language Based on the 2018 Outpatient *Guidelines* from the Alternate Care Sites Subcommittee

Chapter 1.2, Planning, Design, Construction, and Commissioning

***1.2-6.5 Emergency Preparedness and Management**

During project planning and design, the following shall be considered:

***1.2-6.5.1** The likelihood a facility will experience events that go beyond the facility's normal operations

> **A1.2-6.5.1 Emergency preparedness assessment.** The likelihood of a facility experiencing events that go beyond normal operations should be assessed and detailed in an annual emergency preparedness assessment. These events could include natural disasters; utility failures; acts or threats of human violence; biological, nuclear, or chemical exposures; surge capacity; evacuation; or mass casualties.

a. *Infrastructure assessment.* The assessment should consider performance of structural and critical nonstructural building systems during an adverse event and the likelihood of loss of externally supplied power, gas, water, and communications from such a disaster.

b. *Facility planning.* Ideally, the emergency preparedness assessment results will be used to implement practices and plans that will help the health care organization prevent, mitigate, and expediently recover from an event. Facility master planning should consider mitigation measures required to address conditions that may be hazardous to patients and conditions that may compromise the ability of the health care organization to fulfill its planned post-emergency medical response.

Resiliency requires a plan to absorb and recover from adverse events by preparing, preventing, protecting, mitigating, and responding. The emergency operations plan ~~plan~~ should outline a health care facility's ability through mitigation and planning to:

—Handle patient influx due to a public health emergency or mass casualty event.

—Coordinate and communicate effectively with community partners.

—Adapt to changing conditions

—Recover from disruptions

—Resist probable deliberate attacks

—Improve technical and organizational capabilities

—Focus on reducing damage and disruptions to public health and safety

*__1.2-6.5.2__ Space needs in the event of an emergency for operations to:

A1.2-6.5.2 Space needs in an emergency. The location of the facility and the type of event in the community may require a health care facility to act as a shelter or support other health care system needs; if so, this must be considered in planning.

a. Space where patients, staff, and visitors can be safe in an emergency should be identified.

b. Provision of space for resources needed to respond in an emergency, such as medical supplies, materials, pharmaceuticals, communications equipment, transportation, food, water, utilities, and waste storage should be considered during project planning and design. Some of these resources could be accommodated through mutual aid agreements between the health care organization and other local providers or vendors. Such storage capacity or plans should be sufficient for at least four continuous days of operation.

1.2-6.5.2.1 Protect facility occupants during the event.

*__1.2-6.5.2.2__ Continue providing services as outlined in the facility's emergency operations plan (EOP).

A1.2-6.5.2.2 Design for continued building system operation. For facilities that have been designated by a recognized federal, state, regional, or local mandate to remain operational in the aftermath of a disaster, special designs are required to protect systems and essential building services such as power, water, medical gas systems and, in certain areas, air conditioning. In addition, special consideration must be given to the likelihood of temporary loss of externally supplied power, gas, water, and communications.

Chapter 4: Resiliency

Maintenance of existing health care services or an increase in their availability during an emergency condition, whether man-made or weather-related, will likely be vital for a community facing such an event. As is true every day, continuity of service depends on the continued operations and functionality of facilities where patient care is provided. In an emergency situation, the health care facility is the engineered backbone that supports the continued delivery of patient care.

Health care systems in the United States have encountered a variety of catastrophic events, including flooding and sea level rise, wildfires, severe and arctic cold, hurricanes, tornadoes, airborne chemical incidents, biological or radiological attacks, pandemics, and public utility outages.[1] As some of these events—particularly weather-related ones—appear to be happening more often, health care organizations need to develop higher levels of disaster resiliency so they can operate efficiently and effectively when an emergency arises.

Disaster resiliency is defined as "a health or residential care facility's ability to withstand adverse events," that is, to plan and prepare for an event, absorb a surge in patients or residents during an event, and recover and adapt after an event.

The technical guidance provided in this chapter is intended to help facility administrators, facility managers, designers, and builders collaboratively plan for and construct resilient health care facilities capable of withstanding catastrophic events. Multiple event types are addressed, with some select references to help readers further define minimum requirements.

Planning for Resilient Facilities

The best way to develop resilient health care facilities is to plan for resiliency from the outset of a building project. Although this is obviously much easier for a new facility project, it is also possible to make existing facilities more resilient, either through targeted projects with the goal of increasing resiliency or by making planning for resiliency a key part of every major renovation project.

An early step in planning health care facility projects is performance of a safety risk assessment (SRA), which includes a number of focused assessments as outlined in Chapter 1.2 of the FGI *Guidelines for Design and Construction* documents. In Chapter 1 of this white paper, a new risk assessment is proposed as part of the SRA. The chapter explains the differences between hazards and risks and the all-hazards risk assessments health care organizations already conduct at the behest of the Centers for Medicare & Medicaid Services. Information from these required hazard vulnerability assessments (HVAs)—which address the likelihood of emergency conditions, worst-case scenario impacts, facility preparedness, gap analysis, and plans for improvement—can be used in building the disaster, emergency, and vulnerability assessment (DEVA), which will provide more detail regarding the hazards and risks of concern for a particular health care facility project and ways of responding to them.

Risk assessments are the means for a health care organization to identify its facilities' greatest vulnerabilities to emergency conditions that can affect operations and services and to determine how to mitigate these risks. For existing facilities, in particular, it is useful for an organization to review past responses to emergency situations to determine what worked and what didn't and how the facility infrastructure contributed to these outcomes. The results of a DEVA can be used to develop event-specific response plans for the emergency conditions most likely to affect a particular facility, with a focus on how the built environment can support the health care organization's response.

This chapter outlines steps a health care organization may want to take to address a number of emergency conditions, including what to do before, during, and after an event.

Airborne Chemical, Biological, or Radiological Attacks

Protection of a hospital's physical plant against the possibility of airborne chemical, biological, or radiological (CBR) attacks is an important and necessary part of any resiliency risk assessment. CBR terrorism is generally defined as the deliberate release of viruses, bacteria, toxins, ammonia, chlorine, hydrogen cyanide, mustard agents, nerve agents, phosgene, common radioactive materials, or other harmful agents and hazardous chemicals to cause illness or death. Two examples of such attacks are disbursement of powdered anthrax substances and release of the nerve gas agent sarin.

To help a health care organization prepare its facilities to meet CBR threats, the following guidance has been prepared from information provided by the National Institute for Occupational Safety and Health and ASHRAE.

Before an Event

Planning for a health care organization's response in the event of a CBR attack begins with reviewing its annual HVA. When an organization is planning a new facility or major renovation project, this assessment is taken a step further by conducting a disaster, emergency, and vulnerability assessment. In developing a DEVA, specific hazards and risks to the facility are identified and then a determination is made about how these can be addressed in the design and construction of the facility.

Identify hazards from a potential CBR attack

To prepare a facility for resiliency against CBR attacks, the following questions should be considered:

- What is the operational condition of all heating, ventilation, and air-conditioning (HVAC) equipment?
- What filtration systems are in place? What are their efficiencies?
- Is all equipment appropriately connected and controlled? Are equipment access doors and panels in place and appropriately sealed?
- Are all dampers (outdoor air, return air, bypass, fire and smoke) functioning?
- How does the HVAC system respond to manual fire alarm, fire detection, or fire suppression device activation?
- Are all supply and return ducts completely connected to their grilles and registers?
- Are the variable air volume boxes functioning?
- How is the HVAC system controlled? How quickly does it respond?
- How is the building zoned? Where are the air handlers for each zone? Is the system designed for smoke control?
- How does air flow through the building? What are the pressure relationships between zones?

- Which building entryways are positively or negatively pressurized? Is the building connected to other buildings by tunnels or passageways?
- Are utility chases and penetrations, elevator shafts, and fire stairs significant airflow pathways?
- Is there obvious air infiltration? Is it localized?
- Where are the outdoor air louvers? Are they easily observable? Are they and/or other mechanical equipment accessible to the public?
- Do adjacent structures or landscaping features allow access to the building roof?

Evaluate risks from ventilation and filtration hazards and generate solutions for mitigating them

Because CBR agents are generally dispersed through building mechanical systems, these systems should be looked at carefully when evaluating identified risks. Particular concerns are described here:

HVAC systems and controls

The HVAC system should be carefully reviewed to determine which areas are supplied by the building's air-handling equipment and the locations of their controls. It may be necessary to quickly shut down parts or all of the air movement in the building to prevent the spread of contamination. Public areas such as a public lobby, chapel, or dining room, which are more vulnerable to attack because of their accessibility, should have an HVAC system that can be isolated from the rest of the building. Designing a "passive" HVAC system in which ducted air can be quickly shut down is likely the most effective and easily maintained system for accomplishing this.

Air filtration

Typically, health care facilities are equipped with high-efficiency filters in many areas. A review of the filter efficiencies in vulnerable areas should be conducted so that possible upgrades can be considered. Any proposed increases to air filter efficiencies should

be reviewed by a mechanical engineer to determine if air-handling equipment needs to be augmented. All filter housings should be checked to ensure they fit tightly and are secured.

Ducted return systems

Ducted return systems make controlling a release of CBR agents easier than plenum systems do because the latter are open to larger areas in the building, allowing for easier spread of the agents. All plenums should be inspected for complete separation from occupied areas. The building should be divided into zones so that any CBR agents can be corralled into one or two zones.

Building pressure relationships

Health care facilities have mandatory pressure relationships between adjacent spaces (e.g., positive pressure operating rooms, negative pressure soiled linen rooms, negative pressure isolation rooms). Overall, the building should be designed to be slightly positive so that air leakage around windows, doors, and other openings is kept to a minimum. Over time and use, however, a building tends to become more negative to exterior spaces. For overall building safety against outside airborne agents, the pressure differential of the building to the exterior should be analyzed and, if possible, adjusted to be slightly positive.

Maintenance

Over time, a building's mechanical systems degrade. Constant maintenance and replacement are required to keep building systems functioning at the level they did when first placed into service. Regular maintenance of all equipment, replacement of filters, and testing and inspection of both dampers and flow rates in the duct system as well as continued testing to meet operational parameters should be required for all occupied buildings.

Generate whole-building solutions to help mitigate risks

The actions listed here can be taken to protect a facility in the event of CBR attacks:

Prevent access to or establish security zones around outdoor air intakes

Relocate or extend outdoor air intakes to secure them from public access. If relocation cannot be accomplished, provide see-through perimeter barriers, such as fencing, that will not obstruct a clear view of vulnerable areas. Sloped metal mesh could be used to prevent thrown objects from entering or resting on air intakes.

Secure building system areas from public access

Access to HVAC, elevator, water, and other mechanical and plumbing systems and equipment should be secured from tampering or destruction by use of keyed locks, keycards, tamper switches, or key codes. Ladders, doors, and stairways leading to rooms and areas where this equipment is located should be secured from unauthorized entry.

Secure building roofs from public access

The roof of a health care facility is especially vulnerable to penetration of the building envelope. Air ducts, ventilators, exhaust fans, air intakes, plumbing vents, and other openings should be secured from unauthorized access. All possible entry points should be controlled and secured, using fencing, locked doors and hatches, and other security measures.

Provide security measures

Security measures such as security guards, alarms, and cameras should be considered to protect and observe vulnerable locations. Other security measures to consider include access control locking systems, delayed egress locks along with closed-circuit TV, and two-way voice communication at egress doors. To protect patients inside the building, special locking arrangements can be used at exit doors as permitted by building and fire codes. The number of entry doors into the building should be kept to a minimum, and all entry doors should be monitored by closed-circuit television from a 24/7 security station.

Isolate lobbies, mailrooms, loading docks, and storage areas

Public lobbies, mailrooms, and storage rooms are opportunistic areas where CBR agents can enter or be stored inside a building. These areas, including their HVAC systems, should be designed so they are isolated or can be quickly isolated from the rest of the building. Access to the rest of the building from lobby areas should be guarded by security checkpoints. Incoming mail should be inspected in an isolated room or area before it is conveyed directly into the building.

Secure return air grilles

Return air grilles offer another entry into a building's HVAC system. The locations of all return air grilles should be carefully studied to determine how they can best be kept under visual observation or relocated to less noticeable areas.

Restrict access to building operation areas

Because outside workers and contractors have direct access to many of the most sensitive building operation and utility areas, they should either be monitored while inside the building or screened for security issues prior to working inside the health care facility.

Restrict access to building information

Building operations information related to mechanical, electrical, vertical transport, and fire and life safety systems; security system plans and schematics; and emergency operations procedures should be strictly controlled.

Identify general physical plant security needs

Because it is impossible to keep the entire building under close observation at all times, a controlled layering of access for the public and staff should be factored into resiliency planning. Some patient areas may be made more accessible to the public than areas such as the laboratory, surgical suite, or mechanical spaces. An overall plan should be developed so the entire building is categorized into security zones of increasing restriction and observation.

Develop a plant of action in the event of a CBR attack

The biggest challenge during a CBR attack is controlling fear, panic, stress, and misinformation among building occupants. Developing a definitive plan of action for responding to such an attack and having staff periodically practice implementing it will allow the health care organization to respond quickly in the event of a CBR attack.

During an Event

Once an incident is understood to be underway, all components of the health care organization's planned response must be immediately activated. HVAC systems should be zoned or shut down. All facility access and egress points should be secured with locked doors and the posting of security guards. Occupants should be removed from contaminated areas into predetermined safety zones, using assessment and decontamination procedures to be sure no affected individuals are moved into safety zones until they have been decontaminated. These assessment and decontamination procedures should also be applied to new patients arriving from outside the facility.

Control of information being made public is essential to establish real-time facts and counteract rumors and misinformation. Emergency department staff should be trained and prepared to respond to CBR attacks, whether initiated inside the health care facility or elsewhere with affected people transported to the hospital for treatment.

After an Event

After any CBR event, a thorough cleaning of the facility must take place before reentry, if it has been evacuated, or continued occupation. Depending on the type of agent used, safety protocols must be followed to assure no further casualties are caused by the decontamination activity. All equipment that was shut down must be inspected and cleared before it can be activated again.

Once decontamination is complete and the facility is considered safe to occupy and operate, systems must be reviewed and tested to

return them to operational status. This may require a completely new test, balance, and replacement of all filter media.

A review of the effectiveness of the health care organization's procedures and responses should be undertaken as soon as possible to identify measures that must be adjusted in preparation for future events. Revisions to the emergency plan should be made in a timely manner, and staff should be trained in and practice any newly revised portions.

Civil Unrest

Civil unrest or disturbances can arise from any number of causes and may range from peaceful demonstrations and protests, which might evolve into riots and obstructions, to reactions to natural or man-made events in which public safety and damage to property are of significant concern. Regardless of origin, civil unrest often affects health care and health care facilities, necessitating management of associated risks to minimize the disruption of services and maximize the protection of people and property. Incidents involving an active shooter, terrorism, and common criminal activity are not specifically addressed in this section; however, many of the mitigation measures described here may help lessen vulnerabilities to those hazards.

Before an Event

Management of risks entails the enhancement of both physical security features and corresponding operational policies and procedures. Economics, physical facility limitations, the need for openness and accessibility to patients, and other constrains will most likely preclude the elimination of all risks from civil unrest.

The risk management process begins with a health care organization's annual HVA but addresses resilient facility design through development of a DEVA. The DEVA should evaluate existing conditions, identify support needed to facilitate continuation of vital services, and propose a protective strategy for

safeguarding personnel, patients, the public, and critical property assets. Incorporating a concentric layering of infrastructure features and associated policies and procedures into an organization's risk management approach can help maximize the overall effectiveness and value of its risk management process.

Most protective measures can be applied to both new and existing health care facilities. The types of measures or products selected and the extent of their application for new vs. existing facilities may vary but are generally intended to meet similar objectives.

Identify hazards from civil unrest

The importance of a comprehensive and sufficiently detailed risk assessment as a basis for development of a risk management plan cannot be overstated. To aid in appropriately assessing risks, the health care organization may choose to supplement its staff with one or more of the following individuals: a certified physical security specialist in risk and vulnerability assessments, a building control systems specialist with experience in both physical and cyber security, an electronic security systems specialist, and a certified information technology and communications systems specialist.

The risk assessment should include identification of the following:

- ***Vital services provided to the external community that support essential internal business operations.*** This step requires component-level itemization of these services, including a record of the location where each service is performed, days and times each is offered, and the vulnerabilities and interdependencies of these services and locations.
- ***Critical/high-value or supporting physical infrastructure necessary for the continuation of vital services at the major component level.*** This infrastructure comprises buildings, structures, and other property improvements, including building systems and utilities such as data and communications systems, fire alarm and suppression systems, physical access control systems, security surveillance systems, vertical transport systems, lighting systems, HVAC systems,

medical gas and vacuum systems, nurse call and patient monitoring systems, normal and emergency electrical power systems, exterior envelope, on-site fuel storage, and the energy plant. Governing federal, state, and local regulations, permits and licenses, codes, and accreditation standards can identify or assist in identifying critical infrastructure to the major component level.

- ***Staff and their functions in the organization.*** This includes listing clinical and non-clinical staff with their respective work locations, headcounts by work shift, and associations with vital or support services.
- ***Typical inpatient census.*** Sort this information by location, patient criticality, and patient mobility and cite the clinical and support staff, services, space and equipment, areas of refuge, and transportation for staff, supplies, and patients that are needed to provide patient services in emergencies.
- ***Typical outpatient census.*** Sort this information by location, patient criticality, patient mobility, and hours of operation. Also list the staff, services, space, equipment, areas of refuge, and transportation for staff, supplies, and patients that will be needed for the facility to remain operational during an emergency.
- ***Typical visitor and public census.*** Again, sort this information by location, mobility, hours of operation, and the staff, services, space, equipment, areas of refuge, and emergency transport required to accommodate these building occupants during an emergency.
- ***Responding law enforcement or security forces.*** Determine the capabilities, initial response times, primary and alternate means of notification, and process and time for summoning additional law enforcement and/or security forces. In addition, determine any on-site infrastructure and operational support capabilities needed to support these services in single and multiple concurrent threat scenarios.

Evaluate risks from the identified hazards and generate solutions for addressing those risks

Deciding where to defend or retreat

Using the risk assessment framework described above, a series of decisions must be made regarding whether vital services and critical infrastructure will be handled as a "defend in-place" or "retreat" location. "Defend in-place" infers continuation of services, albeit modified, and usually involves hardening of the physical infrastructure to lessen vulnerabilities and increase resiliency to minimally needed levels. "Retreat" typically involves shifting services and personnel to an alternate location to enable continuation of vital services and other operations at a minimally acceptable level.

Initial decisions based on particular conditions or scenarios may not be absolute and can be refined on the basis of practicality, economics, and other relevant constraints. These decisions have a greater impact on existing facilities, typically due to physical constraints and increased mitigation costs.

Developing a protective system strategy

Once a defend-in-place or retreat approach has been chosen for a health care facility, a strategy for implementing relevant protective systems is then developed. Protective systems are defined here as a combination of means and devices intended to provide protection to a defined level against one or more specific threats or hazards. In this application of a protective system, the means and devices can be grouped into three major functions: detection of threat, delay or defeat of the threat, and response by law enforcement or another security force capable of handling the threat.

Applying the individual measures, devices, and associated policies and procedures that make up the protective system is best achieved through use of a concentric layering approach in which each successive layer addresses a greater threat level or breach of the previous layer's protective system.

- **Detection of threat.** Initial and continued detection of the threat and its location and forcefulness will inform decisions on initial and ongoing response actions. Detection is enabled using one or more electronic security systems such as intrusion detection, access control, alarm assessment and communication, and surveillance.
- **Delay or defeat of the threat.** Protective measures are designed to provide varied levels of protection. Depending on the nature and severity of the threat, the same measures may be sufficient to delay the threat or defeat it entirely, thus providing additional time to implement subsequent response actions. Barriers, compartmentation, and distance are some protective measures used in a built environment.
- **Response to the threat by law enforcement or a security force**. Law enforcement or other security forces are relied on to neutralize or contain the threat, secure property and other assets, and facilitate evacuation of persons to safety or safeguard them when sheltering in place. The effectiveness of any law enforcement or security force response may be influenced by, or even depend on, particular site conditions and the design of buildings and other site improvements.

Considering risk at the functional space level

The functional spaces in a health care facility reflect the predominant services the health care organization provides to the community, the type and level of support the facility contributes to the organization's business operations, and the location of critical/high-value assets or infrastructure.

When using the risk assessment to make decisions regarding protection of the facility during an emergency, the following should be considered for each functional space:

- Whether its location is appropriate as far as safety and access to its services are concerned (more flexibility to make changes when designing new facilities)
- Whether a defend-in-place or retreat approach is appropriate (influences application of protective measures and their levels)

- Level of compartmentation and hardening of physical space and servicing utilities (impacted by criticality and defend or retreat decisions)
- Adjacencies to other functional spaces (High-value areas should not be adjacent or proximal to high-risk areas without appropriate mitigations in place.)

Functional Spaces to Consider in Planning for Civil Unrest

The location and criticality to continued operations of the functional spaces in a health care setting should be considered in planning how a health care organization will respond to civil unrest. Following is a list of functional spaces often included in health care facilities.

- Ambulance bays
- Cafeteria
- Child care center
- Clinics
- Data center (main computer room)
- Data/voice communications rooms
- Decontamination facility
- Dialysis facilities
- Electrical service entrances and location of distribution equipment (e.g., switchgear, transformers, transfer switches)
- Elevators and elevator machine rooms
- Emergency department
- Emergency/standby generator location
- Employee/visitor safe areas
- Energy center/plant
- Entrance lobby

- Fire command center
- Fuel storage
- Gift/retail store
- Hazardous material storage
- Helipad/platform
- Hematology/oncology facilities
- Imaging facilities
- Incident command center
- Inpatient units
- Intensive care units
- Laboratory, clinical
- Laundry
- Liquid (bulk) oxygen storage
- Loading dock/service entrances
- Mechanical service equipment rooms
- Patient education rooms
- Patient receiving/drop-off location
- Patient testing areas (e.g., laboratory samples)
- Pharmacy
- Potable and fire protection water storage tanks
- Reception/admissions area
- Records storage/archives (patient and/or business)
- Security control center/security office
- Shipping/receiving/mail room
- Stairwells
- Surgical suites
- On-site warehousing spaces

Selecting protective measures and levels

A comprehensive and detailed risk assessment will provide essential information for determining acceptable risk levels for particular spaces during varying conditions. This information should cover vital services, critical or supporting infrastructure, staffing, patient census, and law enforcement or security forces needed for response. In turn, determining acceptable risk levels will aid in selection of protective measures and decisions regarding the degree to which they are applied.

Determining the levels of risk a health care organization finds acceptable and choosing protective measures to address those risk levels is a process that must be reexamined regularly. Both changes in an organization's facilities and changing circumstances in society or the weather can lead to changes in relevant risks and how they should be addressed.

Site. Some site-related features can serve as protective measures.

- *Landscaping.* Natural landscaping features can be used to delineate public and private spaces, provide barriers, screen assets, and facilitate access control. However, landscaping must not create concealment areas or obstruct surveillance system cameras or intrusion detection sensors.
- *Perimeter barrier.* A perimeter barrier around a campus and/or specific buildings will delineate public from private or less private spaces, provide for access control, and support campus/facility security. When associated with a building or limited area, the barrier should encompass any needed space for gatherings, critical equipment, and other operational needs. Constructed perimeter barriers are typically walls or fences with anti-climb features, integrated lockable pedestrian and vehicle gates, and architectural characteristics that match the campus or building to portray accessibility during normal business operations.
- *Site lighting.* In addition to being aesthetically pleasing, well-designed site lighting eliminates dark or shadowy areas, improving pedestrian and vehicle security. It should also meet

the color and contrast requirements that surveillance cameras need for accurate person or threat identification. Fixture location and type must be coordinated with security system camera locations and view angles to avoid blinding camera imagers or interfering with intrusion detection sensors.

- *Anti-ram vehicle barriers.* Anti-ram barriers are used to protect persons or property from accidental or intentional incidents involving vehicles. Typical locations include facility entrances, seating or other gathering areas, hazardous material and fuel storage areas, and aboveground (exposed) utility system component areas.

  Stationary barriers may be natural (landscaping or hardscaping features) or man-made (e.g., walls, bollards, wedges, cables). Portable barriers, when used, should be provided with all necessary utility quick connections to facilitate ready placement and operation and stored in a secure location until deployed.

  Anti-ram vehicle barriers are designed and rated for specific vehicle types, gross vehicle weights, vehicle speeds, and stopping distances. Site layout and features can be used to limit a vehicle's approach angle and speed, reducing the impact energy on the barrier. Barriers designed and rated for lower vehicle impact energies are usually more economical to construct or purchase and install.

Security systems. Electronic security systems can support one or more major functional aspects of a protective system strategy: detection of threats, delay or defeat of those threats, and support for the response of law enforcement or other security force. In addition to monitoring or detecting threats, security systems can activate remote defensive actions to contain threats (e.g., lock or open doors) and activate a vital communication link that allows isolated or threatened staff to receive directions or psychological reassurance.

The effectiveness of security systems depends on the adequacy of their coverage and control; protection of devices from weather and physical damage; hardening of power, data, and communications cabling; systems compartmentation and redundancy; and alarm

reporting to a protected and staffed security control center. Electronic security systems include:

- Access control (fail secure vs. fail open)
- Duress alarm
- Detection and screening
- Intrusion detection
- Occupancy detection and screening
- Public address/mass notification
- Secure communications (intercom and dedicated phones)
- Security surveillance
- Staff/patient/asset locator

Security systems must be able to store event data as well as maintain and generate reports. These systems should have uninterrupted backup power and ideally should be connected to a time synchronization clock to provide a coordinated time stamp.

Architectural details and building systems. Determining protective measures for these aspects of the building design as well as the level to which they need protection is an important step.

- *Doors.* Doors must have the fire resistance rating required by the applicable building code and meet forced entry and access control requirements determined by the risk assessment. For doors with glazing, see the section titled "Windows, storefronts and glazed doors" below.
- *Walls.* Exterior walls should protect against forced entry and be constructed of fire-resistant materials or, alternatively, protected by a fire suppression system. Typical construction includes reinforced masonry, masonry façade over metal or wood frame, and metal and wood frames with an interior backing of steel security screens or metal partitions.

  Interior walls should be of the required fire resistance rating and should meet forced entry requirements determined by the risk analysis. Partitions separating critical or high-value functional spaces must extend slab to slab, be securely

anchored, and be constructed of fire-resistant materials (or, alternatively, protected by a suitable fire protection system). Reinforced masonry construction is preferred, but if metal or wood stud construction is used, it should be reinforced with full-height steel security screens or metal partitions.

Penetrations such as ducts, vents, and similar openings should be protected by steel grating or bars with opening sizes no larger than 6 inches to limit the size of objects that can pass through.

- *Windows, storefronts, and glazed doors.* Windows, storefronts, and glazed doors should be designed and constructed to meet fire resistance, forced entry and other performance requirements determined by the risk assessment. Typically, window and storefront frames should be of metal construction (aluminum and/or steel) and should be sufficiently anchored to transmit forces from wind pressure, fire hose stream, and forced entry loads to the supporting structure. Exterior glazing at lower building levels and doors should use laminated glass; alternatively, for existing facilities, the addition of a wet glazed or mechanically anchored anti-shatter film (minimum of 7 mm thick) may be used.
- *Ventilation*. Critical and functional spaces with high asset value should be served by dedicated, fully ducted HVAC systems. Compartmentation and redundancy requirements should be included in the risk assessment.
- *Electrical power.* Electrical power distribution wiring should be hardened with lockable power panels to assure restricted access and should be designed to serve the needs of individual functional spaces. Degrees of hardening, isolation, and redundancy are determined by the risk analysis for each functional space.
- *Lighting*. Exterior lighting should be of weatherproof and vandal-resistant construction and be provided with emergency power, as required by the risk assessment. Interior lighting fixtures should be individually restrained or anchored to prevent forced displacement. Vandal-resistant fixtures

should be included in the emergency lighting system to help maintain suitable lighting levels for occupants and security surveillance systems.

- *Plumbing*. Additional piping supports should be provided to prevent the piping system and related components from being forcibly displaced. As well, actuator equipment isolation valves should be provided to prevent flooding or limit water damage.
- *Fire alarm and protection.* Fire alarm and protective systems can support one or more major functional spaces. Like security systems, the effectiveness of these systems depends on the adequacy of coverage and control; protection of devices from unauthorized access and physical damage; hardening of power, data, and communications cabling; systems compartmentation and redundancy; and alarm reporting to a protected and staffed security control center.
- *Vertical transport.* Elevator and dumbwaiter cars should be equipped with surveillance cameras and an access control system to prevent unauthorized transport of persons or hazardous items to other floors of a building.
- *Stairwells.* Stairwells should be constructed to meet code-required fire protection ratings for enclosures and protect against forced entry. Typical construction includes reinforced masonry, but where metal stud construction is used it should be reinforced with a full-height steel security screen or metal partition. Stairwell door, doorframe, and door hardware assemblies in at-risk areas should be of the required fire resistance rating and should meet forced entry and access control requirements determined by the risk analysis.

Achieving a Balanced Response

Elimination of some or all risks from civil unrest may not be attainable. However, effective risk management can be achieved by balancing probability and severity, practicable measures, constraints, and economics. A comprehensive risk assessment is vital to any organization's understanding of critical and vital functional spaces and to the level and duration of protection needed. Because threats

and probabilities are not static, periodic review and validation of previously completed risk assessments are necessary to keep an organization's response plans up to date.

Flooding and Sea Level Rise

Although flooding is a separate adverse event from sea level rise, they are linked because relevant preventive measures are similar and because sea level rise often exacerbates the effects of flooding.

A flood event has an immediate and obvious cause, such as extraordinary rainfall, that causes waterways to rise quickly, low areas to fill with water, and water to inundate structures.

Sea level rise, on the other hand, is a slow, developing event. There is no debate about the fact that global sea levels are rising, although there is some disagreement regarding how fast they are rising, how much they will rise, and what is causing this rise. Sea level rise has already exacerbated recent weather events and has been partially to blame for catastrophic results from flooding at several health care facilities. The rising sea level, whether inches or feet, will have an increasing impact on vulnerable facilities in the future. Preventive actions taken now will help mitigate service interruption, protect patients and staff, and avoid costly physical plant repairs from future flood events, whether caused by weather or sea level rise.

Before an Event

Identify hazards from flooding and sea level rise and evaluate their risks

Most preventive resiliency concepts can be applied to both new and existing health care facilities. The different processes employed for new vs. existing facilities vary slightly, but both are designed to meet the same objectives. For new facilities, the resiliency process starts at the very beginning of concept planning and continues through design development, construction documentation,

construction, occupancy, and maintenance for the life of the structure. For existing facilities, the process starts with a detailed risk assessment to determine critical asset vulnerabilities from damage by flooding, whether caused by actual sea level rise or encroachment from flooding by storm events that may be magnified by sea level rise.

Site analysis

Because sea levels are rising, both current sea level rise and storm surge zone data and data projected 30 to 40 years into the future should be used to evaluate potential sites for new project development. For existing facilities, a risk assessment using this same data should be completed to determine the vulnerability of the structure. Once this assessment has been made, any actions needed to protect or relocate facility assets can be determined.

To determine if a site is appropriate for the location of newly designed health care facilities, its ground level should be carefully studied to assure the site will permit reliable access during all weather-related events.

As well, the site must allow the lowest floor to be elevated to whichever is higher: the base flood elevation of the area plus 2 feet

Figure 4-1: Storm Surge Damage in Mississippi from Hurricane Katrina, 2005

Source: James R. Gregory

or the height of a hurricane surge inundation elevation as described by the Sea, Lake, and Overland Surges from Hurricanes model[2] developed by the National Weather Service to estimate storm surge heights from hurricanes. Without this consideration, the interior spaces of the facility are likely to be subject to direct water intrusion.

In addition to analyzing water inundation levels on the site itself and the required height of finished floor elevations, the surrounding land areas and roadways should be analyzed to assure a new facility does not become isolated or cut off from the surrounding area.

Means for maintaining access to new or existing facilities during and after flooding events, including sea level rise in the future, should be assessed. If it is determined the facility would become isolated from off-site access and the site is still deemed acceptable for new construction or continued use of an existing facility, contingency plans for up to 96 hours of isolation should be carefully developed and designed or renovated into the building and added to the emergency planning criteria.

Facility analysis

A risk assessment of the vulnerability of critical areas in the health care facility should include the following:

- **Patient care areas.** All patient care and treatment areas should be carefully assessed to determine their vulnerability to flooding and sea level rise. These areas should be categorized into those that are essential for adequate patient support and those that can be terminated for a period without endangering patient care.
- **Patient support areas.** The location of medical supplies, medication storage, patient transport equipment, patient lifting equipment, etc., should be carefully analyzed to determine susceptibility to damage or loss from water inundation.
- **Food service and other support areas.** The location and elevation of support functions such as laundry, loading docks, materials storage, clean and soiled linen storage, food

preparation areas, food storage, refrigeration, and all other areas necessary to support patient needs should be studied to determine susceptibility to damage or loss from flooding or sea level rise.

- **Critical building systems.** Identify building support utilities and areas critical to continued operation of the facility that are vulnerable to water intrusion and record their locations.

In particular, a risk assessment of the vulnerability of critical building systems should consider the following:

- **Off-site electrical utility**
  - Is the utility delivered to the building overhead or underground?
  - Is the utility substation subject to damage from flooding or rising sea level?
  - Can the utility offer reliable continuity of service during a storm event and for the overall life of the building?

- **On-site electrical utility**
  - At what flood elevation are the central energy plant or emergency generator and emergency electrical system located?
  - How vulnerable is the essential electrical system (including switchgear, transformers, fuel storage, elevator equipment, connecting service lines, etc.) to damage from flooding and sea level rise?

- **Medical gas utility**
  - Are oxygen tanks exposed to water intrusion?
  - Is supporting equipment for oxygen use, vacuum systems, and medical air tanks located where it can be damaged by water intrusion?

- **Potable water utility**
  - How is potable water supplied to the site?

  - What are the chances of off-site interruption of this water supply?
  - Is on-site water storage available that can supply potable water to all occupants of the building for up to 96 hours? Generally, 3 gallons of potable water per day per patient or resident and 1 gallon of potable water per day per staff member and visitor is considered a bare minimum for water storage.
  - Is a water pump connected to the essential electrical system to deliver the on-site water supply where it is needed? If not, how is this water to be made available to the various areas and floors where it will be used?

- **Ice-making equipment.** How might ice-making equipment be maintained during power or water outages that result in overheated conditions for patients and staff?
- **Non-potable water**
  - What are the vulnerabilities of the fire sprinkler system, and what are the contingency plans when water service is interrupted and the building is no longer protected by a fire sprinkler system?
  - Are there additional fire extinguishers that can be placed in high-risk areas?
  - Have staff been trained to properly discharge a fire extinguisher?

- **Sewage utility**
  - What contingency plans have been considered for an on-site sewage holding system in the event movement of sewage from the facility to an off-site sewage treatment facility becomes impaired?
  - Have pumps for sewage disposal that are supplied with emergency power been considered as part of the essential electrical system?

- **Off-site natural gas utility**
  - Is there a list of equipment using off-site natural gas so that contingency plans can be made for extended gas outages?
  - Has use of dual fuel equipment been considered to allow continued operation of equipment normally fed by natural gas if it becomes unavailable? If so, on-site storage of suitable fuel will need to be planned.

- **On-site mechanical utilities.** Has the location of all HVAC equipment (e.g., air intakes, compressors, pumps, boilers, condensers) been studied to determine if this equipment is susceptible to damage from flooding or seal level rise?
- **Information technology (IT) and communication equipment.** Has IT and communication equipment been protected from water intrusion and supplied with its own separate power backup to ensure that no vital information is lost and constant communication with all off-site legal authorities can be maintained?

Generate solutions to address risks from the identified hazards

It is easier and more cost-effective to insert flooding and sea level rise mitigation solutions when designing and constructing a new health care facility than it is when renovating an existing facility. During a renovation, the disruption, cost allocation, and magnitude of required mitigations may pose a great challenge. Still, many design solutions can be incorporated as part of a larger overall renovation project so that mitigation can be accomplished without causing serious budgetary concerns.

Site solutions for new facilities

For new sites deemed to be in danger from sea level rise or flooding, site enhancements such as raising the building location or the entire site above projected flooding or sea level heights can be considered.

However, if the land area around the site is not significantly raised as well, this will likely result in the creation of an isolated structure, although public roadways and existing bridges are already being modified in some areas affected by sea level rise. For this reason, local zoning and planning work should be examined to determine the long-range viability of raising site grading. If the results will be a health care facility eventually cut off from the rest of the land, efforts to alter the site's makeup may not be a worthwhile mitigation expense or effort.

If a facility must be located in an area known to be affected by flooding or sea level rise, the first floor of the building should be designed for expendable uses, such as a parking garage, retail shops, or non-critical outpatient facilities. No critical utilities should be located below the possible level of flooding or sea level rise predicted for the life of the building.

Site solutions for existing facilities

Sitework cannot easily mitigate the risks from flooding to a low-sitting existing health care facility. Therefore, other mitigation ideas should be considered. Following are some suggestions:

- **Inflatable bladder dams.** One solution is on-site storage of large water-filled bladders or tube dams that can be positioned around the structure to protect it from water intrusion. Unlike earthen dams or sheet pile coffer dams, these barriers are not permanent and can be installed for a coming weather event and then removed after the event has passed. Their deployment may present a life/fire safety hazard if evacuation routes from the building are blocked. But if the structure can be vacated, it can be protected from high water events and reoccupied immediately.
- **Concrete walls.** Concrete walls designed to protect the structure from flooding and sea level and tide rise should be integrated seamlessly into the landscape and walkways.
- **Earthen dams or land contour.** Assuming there is sufficient land area around the facility, the surrounding areas can be enhanced with sculptured mounds that work as dams to

prevent high water intrusion. Landscaping cover plants that are not susceptible to saltwater should be considered.

- **Interior flood walls.** To protect the critical areas of the building from water inundation, interior flood walls can be used. A glass-enclosed lobby is an inviting environment for visitors and patients but cannot be protected from water inundation caused by flooding or high tides and wind events. However, flood-proof walls located inside the building can protect the vital elements of the facility while giving up the expendable parts, such as glass enclosed lobby areas.
- **Exterior flood-proofing.** In many cases, the exterior of existing buildings can be flood-proofed up to the height of expected flooding if existing windows and vent openings are above these heights. As well, egress doors in the exterior wall can be flood-proofed or a concrete wall with a flood-proof gate designed to protect the door openings can be added.

Building solutions

Similar design solutions to protect against flooding and sea level rise have been incorporated into both new facility designs and renovation projects. The basic idea is to make sure the building's critical systems and services can survive a high-water event.

- **Below-grade locations.** To provide resiliency against flooding or sea level rise, nothing should be located below the established grade, including a basement, an elevator pit, or any electrical services. If zoning or local ordinances require critical service equipment to be located in a spot below the established grade, these areas must be designed to be watertight and have an entrance that will remain dry even during a high-water event. Power and controls for vertical transportation must not be located in an area subject to flooding.
- **Grade-level locations.** Unless the finished grade level of the facility is sufficiently elevated to protect against expected future sea level rise, the building infrastructure must be designed to withstand all expected flood pressure, wave action, or surge inundation forces. Breakaway structures should be used to

prevent water pressure from impinging on the building and causing catastrophic structural collapse. It should be possible to turn off air distribution systems supplying ventilation to any ground floor space and seal them from the facility's patient care spaces. All areas below expected flood elevations should be expendable, and utilities serving them should not be interconnected with utilities for the rest of the building.

If the land located immediately around the facility is not also sufficiently elevated above expected future sea level rise, it should be left undeveloped or contain only expendable assets.

- **Elevated locations.** All critical building systems and patient support services, as listed above under the "Facility analysis" head, should be located at higher elevations in the building enclosure to secure them from water intrusion. Achieving this for existing facilities may require a prolonged renovation project to relocate existing utilities and services higher up in the building.

During an Event

Unlike catastrophic events such as a dam failure or tsunami, response to most flooding events caused by natural occurrences can be planned in advance and the emergency operations plan quickly activated when needed. When this plan is implemented, predetermined personnel begin relocating key assets and equipment to secure and dry areas, protective barriers and gates can be set in place, and patients and all necessary care items can be secured inside the building. Communication with local emergency personal should be maintained and water levels monitored throughout the flooding event.

After an Event

After a flooding event, the facility must be thoroughly inspected to find where water has penetrated the structure. Even small amounts of water can cause mold and mildew growth within 72 hours. Drying equipment must be immediately deployed to all areas where

there has been water intrusion. Patients must be evacuated from these areas, and HVAC systems in these spaces may need to be shut down and rebalanced. Moisture meters can be used to check materials, such as the backsides of drywall, where contamination cannot easily be observed.

A further systematic review and survey of the facility and its surrounding landscape should be made to determine if and where further flood deterrents should be added. A plan should be developed to address these issues, and a budget allocated to further protect the facility from future flooding or water inundation.

The cost to prepare for flooding and sea level rise may be high, and in existing facilities implementation of needed adjustments may disrupt patient care and staff areas. However, by carefully developing an overall plan that may take several years to achieve, such mitigation can be achieved. Coupling these mitigation actions with new additions and renovations already planned for patient care and treatment areas can be a positive move to offset the costly expense of making the facility more resilient.

Hurricanes

Hurricanes are the most violent storms on earth and typically form in the tropical and subtropical regions near the equator. These storms are also referred to as cyclones and typhoons, depending on where they occur. Warm ocean water, moist air, low pressure, and wind contribute to the creation of hurricanes. In North America, the Atlantic hurricane season is the period from June through November, when hurricanes are most prevalent. Tropical cyclones in the Atlantic can be classified as tropical depressions, tropical storms, or hurricanes depending on the severity of the storm.

Hurricanes are measured from Category 1 to 5, from minimal damage at landfall to catastrophic damage, respectively. Hurricanes bring with them severe winds ranging from 74 mph as Category 1 to 157 mph and beyond as Category 5.

Strong winds are one of the most damaging aspects of hurricanes, ripping elements off buildings, invalidating structural integrity, and generating large wind-borne debris fields, which can penetrate building envelopes and cause significant hazard to occupants and the building itself. In addition to wind, storm surge and inland flooding are also major threats. Loss of building services like domestic water, power, and conditioned air can have a huge impact on whether a health care facility's operations can be maintained before, during, and after a storm. Refer to Appendix 4-1 for a case study on Superstorm Sandy.

Before an Event

To prepare its new and existing facilities for resiliency against hurricanes, a health care organization should conduct a disaster, emergency, and vulnerability assessment (DEVA). Following is a list of possible areas of concern to review as part of the DEVA process.

Building structural and envelope integrity

Hurricanes present a threat to the physical building environment from strong winds and flying debris. The potential for damage can be assessed by evaluating the following:

- Anticipated ultimate wind speed based on the location of the facility
- Wind-borne debris potential based on the location of the facility
- Wind exposure category based on the location of the facility
- Structural integrity of the facility (ability to withstand ultimate wind speed and wind pressures)
- Ability of the building envelope to withstand impact
- Quantity of site features (e.g., furnishings, awnings, canopies, rooftop screens, antennas, fencing) that could become flying debris and damage other parts of the facility/campus

Figure 4-3: Aerial View of Flooding from Hurricane Katrina

In 2005 Hurricane Katrina caused significant flooding in New Orleans, bringing water levels up to the roofs in the 9th ward.

Source: *The Advocate* (https://www.theadvocate.com/baton_rouge/multimedia/photos/collection_16fc1d4e-ca6c-11e9-a71b-7b9de6d3e77d.html#5)

Analysis of flooding potential

Storm surge is a serious hazard to health care facilities in coastal communities. Category 1 storms bring an average of four to five feet of storm surge, while Category 5 hurricanes can have upwards of 19 feet of flooding. If unique tidal conditions such as a king tide coincide with severe hurricanes, the results can be that much more devastating.

The location of critical equipment such as emergency generators and electrical panels should be reviewed to see if they fall within

the 100-year and 500-year flood lines as identified on the Federal Emergency Management Agency's (FEMA) flood maps.[3]

Potential disruption to building access and services

Debilitated roadways, scattered debris, fallen trees, downed power lines, and flooding can present challenges for emergency responders, critical vendors, and licensed practitioners trying to access the facility. Health care organizations can assess the likelihood of future access challenges by evaluating the following:

- Location and size of matures trees along emergency routes, service routes, and other critical routes that may fall and prevent access to critical entry points of the facility
- Location and size of matures trees along major underground site utility lines. Fallen trees with ripped-up root systems have been known to break water and other utility lines, disabling services to nearby buildings.
- Elevation of critical entry routes compared to the 100-year and 500-year flood lines on FEMA's flood maps
- Possible alternate location for loading dock activities in the event of major flooding at the facility's loading area
- Safe locations for a potential emergency generator appropriately distanced from outside air intakes and bulk oxygen storage
- Clean water supply and availability if the delivery process is disrupted for an extended period
- Essential medicine and medical supply required to maintain operations if the supply chain is disrupted for an extended period

Potential HVAC, power, domestic water, and communication disruption

During and after major storms, communities are often left without power, domestic water, cellular service, and other communication methods for an extended time. The inability to access power can

prove fatal for health care patients reliant on life-saving devices and procedures. In warmer climates, the absence of mechanically cooled air can have a detrimental impact on the health of the elderly. Facilities can assess the likelihood of utility disruptions and their consequences by evaluating the following:

- The ability of rooftop antennas and communication devices to remain intact during high-velocity winds
- The high-velocity wind resistance of enclosures for essential exterior equipment such as cooling towers, oxygen tanks, air-handling units, and emergency generators
- The organization's ability to acquire alternate power and fuel sources if the usual supply chain is disrupted

During an Event

Health care facilities may be overwhelmed by patients, families, visitors, and staff during and after a storm event. Planning for flexible, adaptable spaces that can accommodate unique functions during a storm is key to a resilient facility that can handle this surge in building occupants.

Surge capacity

The facility emergency operations plan should identify spaces that can be used to increase facility capacity, and staff should have been trained in their use so the organization can quickly increase surge capacity during an event.

For new facilities, some spaces should be designed so they can be repurposed for surge. In existing facilities, spaces should be identified that can serve these purposes. See the surge capacity chapter in this white paper for more information.

Incident command centers

As a hurricane approaches, the health care organization can activate an incident command center to direct the organization's response to the event.

Multiple spaces in the facility should be designed for use as an incident command center during an emergency event. These spaces can double as conference rooms or boardrooms during non-event periods. Communication links, emergency power and lighting, auxiliary environmental controls, restroom/shower facilities, and nourishment amenities should be available for use during a hurricane.

Spaces used as incident command centers should not be located on perimeter/exterior walls.

After an Event

A review of the health care organization's response to the hurricane event should be undertaken afterwards to determine which actions worked during the event and which did not. Performing this task as soon as possible after the event will help staff remember what happened.

Careful evaluation and documentation of the organization's emergency response can help improve preparations to respond to future events. Revisions to the emergency operations plan should be made in a timely manner, and staff should be trained in its requirements so they are prepared to implement it.

In future facility design and planning efforts, paying attention to the following considerations will help achieve a more resilient facility.

Building envelope

- Use of hardened exterior wall systems that are either "Florida Product Approved" or have a "Notice of Acceptance" from Miami/Dade counties, which require impact resistance in high-velocity wind zones (Florida Statute, Section 553.842)
- If hardening the entire building envelope is not an option: hardened exterior wall systems as described above for mechanical and electrical equipment rooms, including the central energy plant

Communications

- Installation of removable rooftop antennas
- Provision of a shortwave two-way computer radio interface

Critical clinical spaces

Location of critical function spaces (e.g., operating rooms, intensive care units, trauma rooms, radiology facilities, hot lab) away from the exterior of the building

Building services and utilities

- Redundant domestic and gray water design through use of wells, ponds, and water storage tanks
- Means for protecting lift and pumping stations from damage so they remain operational
- "Fail secure" rather than "fail safe" electrical design to allow equipment to power on when power is available
- Provision of impact-resistant wall enclosures around cooling towers, air-handling units, bulk oxygen storage tanks, emergency generators, and other essential operating equipment located outdoors
- Design of protected external connections to utility and other vital systems (e.g., bulk oxygen; domestic water; diesel fuel, including the pump; emergency generator set; chilled water; emergency power to temp chiller)
- Limited use of rooftop-mounted equipment
- Use of variable frequency drives for base load chillers

Pandemics

A pandemic is an epidemic that has spread over multiple countries or continents. While pandemics are relatively rare, they do present unique challenges for health care facilities. In all modern cases, health care has been significantly affected by the development of a pandemic.

Some pandemics may be slow to develop and travel from remote locations (e.g., COVID-19, Ebola, Zika virus), while others have developed in the United States and spread worldwide (e.g., influenza epidemic of 1918). During the COVID-19 pandemic, hospitals were severely challenged to adapt to several issues, including fluctuating positive patient populations, bed capacity shortages, the need to isolate airstreams and segregate patients, remote testing issues, and staff protection concerns. Despite these difficulties, hospitals are the first and sometimes the last line of defense in a pandemic.

Before an Event

Pandemics are not predictable as they are caused by multiple, often uncontrollable factors. However, a health care organization can prepare its facilities to respond to a pandemic or a more local epidemic, beginning with a disaster, emergency, and vulnerability assessment.

Part of planning for an organizational response in the event of a pandemic is determining how the facility would be used. Work closely with clinical staff with infection prevention and infectious disease expertise to determine actions the organization can take and identify locations where each of these will occur.

Facility spaces needed to respond to a pandemic, including the following, should be identified:

- Sites outside the hospital that can be used for test/triage (once inside, contamination can make a facility unusable for patient care)
- Entrances that can be closed to limit access and entrances that will be used to manage entry to the hospital
- Locations for monitored checkpoints to manage the inflow of patients and for routes between entrances and these checkpoints
- Patient care locations for infectious patients who require isolation from other patient populations

- Location of all airborne isolation and other negative pressure rooms
- Location for a stockpile of personal protective equipment (PPE) to protect staff

Identify hazards and evaluate their risks

Risks from ventilation systems caused by a pandemic should be evaluated in the context of a particular facility.

HVAC systems and controls

The HVAC system design should be reviewed to determine which areas are supplied by the building's air-handling equipment and the location and controls of this equipment in each area. It may be necessary to quickly shut down parts or all of the air movement in a building to prevent contamination spread.

Air filtration

Typically, health care facilities are equipped with high-efficiency filters in many areas. Filter efficiencies in vulnerable areas should be reviewed to assess the need for upgrades. Any changes in filter efficiencies should be reviewed by a mechanical engineer to determine if air-handling equipment also needs to be modified.

Building pressure relationships

Health care facilities have mandatory pressure relationships between adjacent spaces (e.g., positive pressure operating rooms, negative pressure soiled linen and isolation rooms). Overall, the building should be designed to be slightly positive so that air leakage around windows, doors, and other openings is kept to a minimum. With use over time, however, buildings tend to become more negative to exterior spaces. To protect a building from airborne agents, the pressure differential of the building to the exterior should be analyzed and, if possible, adjusted to be slightly positive.

Generate solutions to mitigate risks

Functional spaces

- Identify spaces for mass decontamination of persons and plan for decontamination of facilities.
- Identify alternate testing locations and equip them for emergency mode. Plan for long-term pandemic conditions that may span seasons where outdoor checkpoints are considered.
- Provide isolation spaces where possibly infectious patients can be evaluated.
- Identify potential alternate care sites and equip them for patient care in an emergency.
- Establish a location for a stockpile of PPE and stock it.
- Design rooms that can be rapidly converted to negative pressure by modifying the supply and/or return airflow in the room and switching from 100% return air to 100% exhaust.
- Size waiting rooms to allow for physical distance adaptability.
- Employ modular units to increase surge capacity, limiting each unit to patients ill with the same disease.
- Consider providing respite areas for front line staff so they can decompress.

Architectural details and surfaces

- Build in ports through walls/windows to outside air that can be adapted for negative or positive pressure.
- Employ doors with deployable seals to enhance separation and air control.
- Use solid surfaces that can withstand frequent disinfection with strong cleaning agents for sinks, work surfaces, patient furniture, and other locations that require frequent disinfection.
- Consider use of antibacterial finishes such as copper or silver ion.

- Avoid carpet and wallcoverings that can harbor infectious microorganisms and are difficult to clean.

Building systems

- Design a passive HVAC system in which ducted air can be shut down quickly. This is likely the most effective and easily maintained system for facilitating the isolation of different building locations in an emergency. Build flexibility into the system to allow for adaptation of floors and wings for care of infectious patients.
- Check all filter housing to ensure it is tight-fitting and secured. Implement any equipment upgrades required by changes in filter efficiencies.
- Connect HVAC systems to an essential electrical system.
- Consider use of touchless sinks, toilets, urinals, and drinking fountains.

Security measures

- Create boundary access points that can be set up during a pandemic to respond to the need for:
  - Interception and isolation of potentially infectious patients (create a health status screening process.)
  - PPE safe zones for staff to work
  - Decontamination locations
  - Spaces to practice donning and doffing PPE
  - Disposal of medical waste (avoid cross-contamination.)

- Secure sensitive areas from unauthorized access. This is an appropriate security approach to implement at any time, and often entails the use of fencing and locked doors and hatches. However, use of entry points that must be monitored to prevent unauthorized access should be limited due to the staffing needed to support them.
  - *Secure building system areas and equipment from public access.* Access to equipment for utilities such as HVAC,

elevators, plumbing, electrical systems, and so on (e.g., air ducts, ventilators, exhaust fans, air intakes, plumbing vents). should be secured from tampering or destruction by use of keyed locks, keycards, or key codes. Ladders, doors, and stairways leading to these rooms and areas should be secured from unauthorized entry.

  - *Secure building access points.* Management of the entry of staff, visitors, patients, and vendors through a facility is essential, particularly during a pandemic. All possible entry points should be controlled and secured.

- In addition to the physical environment security features described above, security measures such as guards, alarms, and cameras should be considered to provide additional protection. The use of access control locking systems and delayed egress locks along with closed-circuit TV and two-way voice communication at egress doors can be employed. Special locking arrangements at exit doors that are permitted to address the security needs of patients inside the building can also be used and coordinated with fire code requirements.

During an Event

- Implement the Hospital Incident Command System (HICS), with its assigned roles, to facilitate communication across the organization. Included are key subject matter experts (e.g., infection prevention, patient safety, medical staff, communications liaison, logistics and operations).
- Use clear communication channels to send consistent messaging to all staff at all levels.
- Enforce rigorous standards of conduct, PPE use, and enhanced awareness of risks and mitigation efforts. The goal is to prevent staff from becoming patients.
- Practice physical distancing—"all you need and nothing more."
- Make use of alternative work schedules (e.g., permit work from home or remote locations or access a labor pool to sustain essential clinical and support services.

- Employ telemedicine capabilities if the organization has planned for this.

After an Event

- Collect feedback on lessons learned that can drive future strategies while the event is still fresh in mind.
- Thoroughly disinfect all facility areas to mitigate reemergence of the pandemic.
- As soon as feasible, return to normal operations.

Severe and Arctic Cold Events

Climate change in the 21st century is continuing in an unpredictable pattern that has resulted in sea level rise, heat waves, and an increase in severe weather such as arctic cold and polar vortex events. In northern climates, building designers take arctic cold into account by following prescribed severe cold weather codes and incorporating best practices where appropriate. Both older buildings and newer buildings, even those with complicated designs, can be adversely affected by the cold. The design community and maintenance teams need to holistically assess all facilities with a critical eye because every facility is unique, buildings and their constituent parts age at different rates, and all these systems need to perform during cold weather. Refer to Appendix 4-2 for a case study on the Polar Vortex of 2019.

Before an Event

To prepare its facilities for severe or arctic cold events, a health care organization can undertake a combination of structured assessments, preventive maintenance procedures, and—in some cases—testing of building systems. This begins with a disaster, emergency, and vulnerability assessment, which involves identifying risks, evaluating the likelihood and consequence of those risks occurring, and generating solutions for addressing the risks.

Plumbing and other water hazards

Pipes vulnerable to freezing may carry water for sprinkler systems, HVAC systems or cooling coils, and domestic/potable water systems. Many facility problems from severe cold events are caused when uninsulated or insufficiently insulated piping systems freeze, inhibiting water movement. Although the effects of the system going down during the freezing stage may not be immediately apparent, the effects can be dramatic when these piping systems thaw.

Snow melt after a severe cold event can cause problems at roof drains, at roof/parapet flashing interfaces, and in downspouts or drains. It is usually not the initial thaw that causes the problem but continual freeze/thaw cycles that have this negative impact.

When evaluating freeze risks from water, consider the weather in the facility location and whether and how often a severe or arctic freeze can be expected. Then, identify ways to address expected freeze risks.

One way to mitigate potential damage from snow melt is heat tracing of sensitive areas. For plumbing systems, the concept is simple: do not allow a water pipe to freeze. Suggested solutions for addressing freeze risks in plumbing piping include these:

- Properly insulate water piping systems and valves for expected cold weather. Exterior piping or interior piping adjacent to an exterior wall is most vulnerable to freezing. (Note, however, that sprinkler systems generally are not insulated so when they are installed in a known potential cold environment they are designed as dry pipe pre-action systems.)
- Avoid placement of uninsulated pipes near outer walls, in interstitial areas such as building overhangs, and in unconditioned mechanical spaces.
- Piping located outdoors or on an exterior wall where it is not practical to insulate the piping can be heat-traced or have glycol or another chemical treatment added to prevent freezing. Systems that use a chemical treatment may require a

higher degree of maintenance, including draining the system when operating in warmer weather. Preventive maintenance work orders in a computerized maintenance management system should assure the facility management team drains the pipes when the cold weather season is over. Temperature sensors in piping systems connected to the building automation system can also keep the maintenance team on top of conditions as they change.

Mechanical equipment

Inside environments are designed to keep occupants at a comfortable temperature at all times. In project planning and design phases, a variety of conditioned air systems will be developed to keep entry lobbies, corridors, and individual functional spaces at a design temperature.

Some mechanical devices can easily freeze if exposed to severe or arctic cold. Problems typically occur at transition locations, either building to building, adjacent garage to building, or bridge to building. Often the temperature and pressure differential between these spaces causes air movement, which brings cold air into a space not designed for it. Uninsulated and unconditioned interstitial spaces that contain piping systems can also be problematic.

Proper location of mechanical devices such as an air damper actuator is important as these devices can easily freeze and cause the dampers to stick in position. Heating and cooling coils can also fail if not maintained properly.

Solutions for addressing risks to mechanical equipment from freezing include these:

- Locating mechanical devices with dampers in a conditioned air space is preferable. An alarm system tied to the building automation system will provide a warning during a severe cold event.
- In the fall, before heating season begins, equipment containing coils (e.g., air-handling units, heat exchangers)

should be inspected for corrosion, cracking, and other damage. If access to the coils is difficult, means to allow access should be installed.

- Use of local heaters, fin tube systems, and other equipment can sometimes slow the path of cold air movement and should be considered. Fin tube systems and local heaters in adjoining spaces may mitigate the passage of cold air.

Building envelope

When considering effects from severe cold, the continuity of the building envelope is key, including the integrity of the roof and the building skin.

While there are too many types of systems to discuss in detail in this paper, note these common trouble spots:

- Exterior doors in the building envelope could freeze and stick, allowing cold air into areas not designed for it and causing other issues.
- Humidified buildings with exterior envelopes that lack thermal breaks or window systems with low condensation resistance factors will freeze, and when the moisture thaws it may cause adjacent drywall to become wet.

One solution to the passage of cold air into a building is use of vestibules at wide-open entrances. Consider using revolving doors or offset doors to minimize infiltration of outside air.

During an Event

A severe cold event is generally predicted by weather experts, both in terms of timing and severity. This means health care organizations and facility staff will have time to take measures to protect the health care facility.

Below are some actions that can be taken to prepare for an expected severe cold snap:

- Deploy industrial-size portable heaters in areas where cold is blowing in or areas where heating systems cannot keep the environment comfortable. These heaters should be kept on hand so they can be readily deployed when needed.
- Keep a trickle of water flowing in the sinks of bathrooms, utility rooms, etc. that are located on outer walls to slow any freezing effects.
- Drain heating and cooling coils or add glycol (normally a seasonal change preventive measure) to protect them.
- Evaluate capacity levels of major infrastructure supplies such as fuel oil, liquid propane, bulk oxygen, and medical gas tanks. Arrange for deliveries of these items prior to an extended cold snap.
- Have additional maintenance workers available and third-party contractors on standby for the duration of the severe cold event.
- Designate sleeping areas for workers who need to stay overnight in the facility or on the campus so they can respond to emergencies.
- Set up 24/7 rounding schedules for maintenance staff and other support.
- For hospitals, be prepared to implement the Hospital Incident Command System to lead the emergency response effort.

Once the cold weather event arrives, facility managers should be prepared to respond to calls about broken water pipes, snow buildup, etc. Following are some monitoring activities that should take place during the cold snap:

- Rounding vulnerable areas to check space temperatures, especially in vestibules, lobbies, loading docks, and other areas with openings that allow cold air to enter
- Monitoring of air-handling unit operations, including discharge air temperature, mixed air temperature, and outside air damper positions

- Monitoring of temperatures in areas not normally occupied that have water pipes located near exterior walls
- Removal of snow buildup on roofs and other areas

After an Event

Recovery

Surviving a severe cold event is not always cause for a sigh of relief. Depending on the severity of the cold, it could be a day or so before the effects of the cold on water systems, mechanical systems, and floors immediately below roofs appear. Facility managers must be prepared to respond to water issues, from burst pipes to roofs that have thawed or have cracks in the roofing membrane that allow water from snow melt to drain into finished spaces. All the facility's infrastructure systems should be inspected to ensure uninterrupted operation.

Some areas in the building that were not accessible beforehand may have experienced issues with water and air during the event. Once it is known these areas are vulnerable, plans should be made to install access doors, hatches, or other means to allow access in the future.

Evaluation

Once event recovery is complete, it is time for a post-event evaluation. Steps in this may include the following:

- Consider ways to stress-test newly improved or installed systems.
- Consider building mockups of similar areas and testing them.
- Hire a third-party forensic specialist to investigate problematic areas and systems.

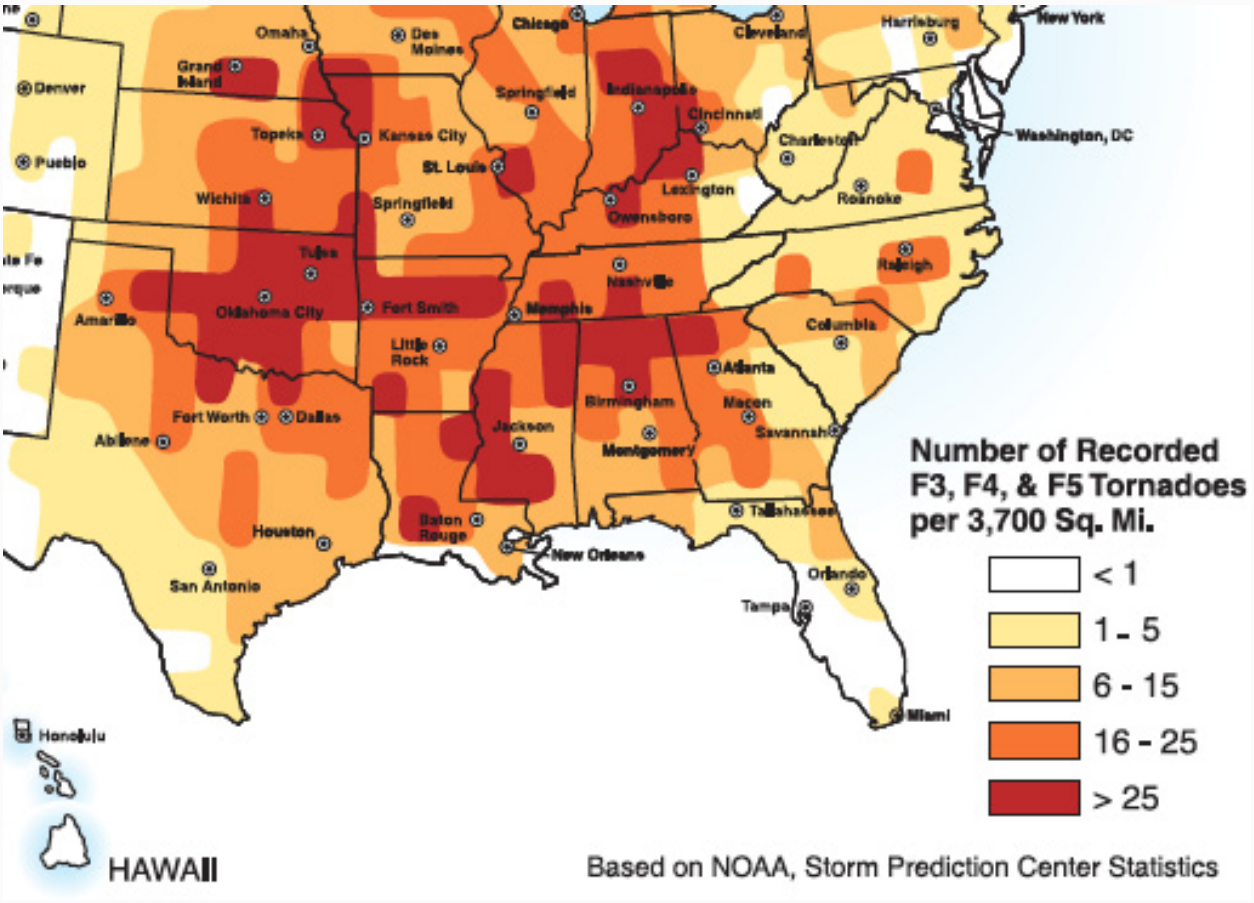
Much of what has been described in this section is not new. The effects of severe cold on the built environment can be planned for when facilities are designed and/or renovated. Architects and engineers need to discuss and work with maintenance staff to develop the best approaches to preventing or mitigating cold

weather effects. These measures should not add to the cost of constructing a new building. The real cost in accommodating severe cold is in the repair and recovery efforts needed after an event; these costs cannot be predicted, but careful proactive design is likely to reduce the need for such repairs.

Tornadoes

Although tornadoes have typically occurred in less populated rural areas, their occurrence is becoming more prevalent across the nation, regardless of community size or density. In 2019 NOAA

Figure 4-4: Number of Recorded Tornadoes In 2011



Source: Northeast States Emergency Consortium

statistics show the highest number of tornadoes in the United States since 2011, with a total of 1,520 and 41 direct fatalities.[4] For the safety and survivability of those in the path of a tornado, it is imperative that critical buildings and infrastructure, including hospitals, remain functioning to the greatest extent possible when a tornadic event occurs.

The predictability of tornadoes is largely based on location. Significant advances in meteorological science have enabled an increased level of precision in predicting weather and the threat of tornadoes. However, time to prepare for such an event remains a matter of minutes and, because time to prepare is a considerable factor in successfully managing the event, resiliency provisions should be planned and constructed into a building whenever possible.

The level of structural and utility resiliency provided should be carefully considered by organizational leadership as it can vary depending on the desired post-event outcome. As an example, here are three different levels of designing for resiliency:

1. Provide life safety for the immediate threat to patients, staff, and visitors in the building when the tornado strikes, but not for maintaining operations after evacuating the building.
2. Provide for operational continuity of the structure and systems to permit continued minimal operations.
3. Provide for full business continuity of the site, structure, and systems so health care services to the community can be provided after the storm has passed.

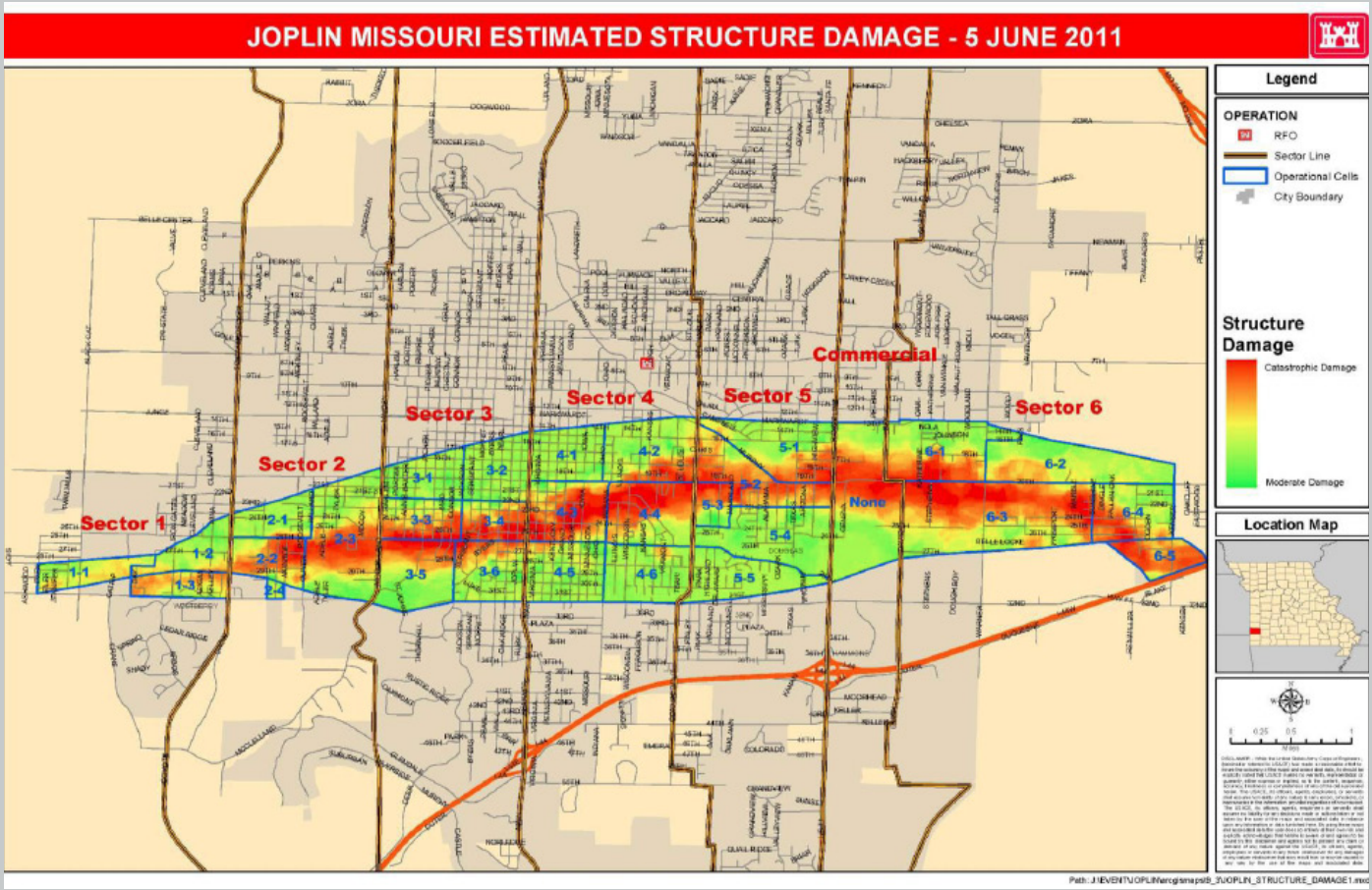
Tornado Destroyed Medical Center in Joplin, Missouri

On the evening of May 22, 2011, an EF-5 tornado hit the city of Joplin, Missouri. The storm damaged or destroyed more than 8,000 homes and businesses, including the complete destruction of what was formerly

known as St. John's Regional Medical Center. The hospital took a direct hit from the tornado, which blew out windows, destroyed the roof, and severely damaged all the infrastructure, knocking out utilities and causing structural damage. The hospital was a complete loss. Although five lives were lost at the hospital, the hospital staff functioned at the highest level possible, protecting, relocating, and evacuating patients. When the hospital was rebuilt, as Mercy Hospital, the design included more than 38 provisions to harden the facility with the intent of providing a more tornado-resilient structure. Most of these provisions are described in this white paper.

There is no way to predict exactly where or when a tornado will hit. Providing resilient buildings in areas prone to these storms is the most basic thing that can be done to prevent loss of life and property.

Figure 4-5: Structural Damage from Tornado in Joplin, Missouri, May 22, 2011



Source: U.S. Army Corps of Engineers

Before an Event

It is impossible to predict whether a health care facility will ever be hit by a tornado. However, a facility's vulnerabilities can be determined by preparing an HVA, which will reveal the need for increased building and infrastructure resiliency at a particular location. The HVA should be regularly evaluated to keep it current with climatic changes.

Then, for each new construction or major renovation project, a DEVA should be prepared to identify the hazards and potential risks from emergency conditions that may affect the completed facility and measures that can be built into the facility to increase its resiliency, based on the level of risk a health care organization finds acceptable.

Identify hazards and evaluate risks from identified hazards

The hazards to the facility elements described here should be considered when determining the level of acceptable risk associated with a tornadic event.

Site analysis

Identify site hazards that could adversely affect the usability or accessibility of the health care facility. Each site should be assessed for past storm statistics and research, considering positioning and configuration of buildings, direction of potential tornadic travel, geometry of buildings, and location of critical patient care services to identify potential hazards from tornadoes.

Location of key rooms and departments

Determine which departments may need to remain operational during a tornado for patients who are currently undergoing a procedure and after the event to support the community. For example, the location of the emergency department, ambulance entrance, emergency entrance, and surgical department should be reviewed for accessibility during and after an emergency.

Building envelope

Evaluate the composition of exterior wall assemblies, windows and frames, roofs, and rooftop equipment and whether they can withstand high impacts from debris and wind. Identify areas that would be especially vulnerable to damage.

Defend-in-place zones

Although health care organizations primarily use a defend-in-place strategy for protecting patients in the event of a fire or other contained emergency, planning for a more widespread emergency response requires a more restricted view of this approach. Defend-in-place zones should be dedicated for the most acute patients, those who—due to the critical nature of their illness (e.g., patients on ventilators, patients in protective environments)—could suffer detrimental effects if they are moved. What constitutes a defend-in-place zone should be determined during the emergency planning process. Then, when conducting the DEVA, identify areas of the building that house the most acute patients and identify the hazards and evaluate the risks to them in the event of an emergency.

Means of egress

During an extreme event a building may need to be evacuated, despite the organization's defend-in-place strategy. Therefore, consideration should be given to the risks involved in moving the sickest patients as well as all other building occupants if an evacuation becomes necessary.

Utilities

The location and redundancy of essential utilities should be identified, and the effects that would result from the loss of each utility service should be evaluated.

Generate solutions to mitigate identified risks

Careful consideration should be given to the following site and building components according to desired building performance

objectives based on the outcomes determined by the DEVA. Included below are sample prescriptive measures that could be adapted to mitigate hazards resulting from a tornado; these do not include all possible resolutions.

Site preparedness

Ways of maintaining access to the building during and after a storm should be considered. Possibilities include the following:

- Avoid use of imposing vegetation in landscaping.
- Avoid locating primary driveways that connect to the site in areas where debris from damaged structures may obstruct access.
- Restrict access at the site perimeter to prevent unneeded access; this could be accomplished with temporary barricades.
- When a separate utility plant is provided, its site should be afforded the same considerations.

Hardening of key rooms and departments

Some suggestions for hardening these spaces are outlined here; these are not exhaustive lists.

- The room types listed below should be located away from the exterior wall when possible. Where this is not possible, consider following some of the construction recommendations for hardening the room enclosure in the next list below.
  - Incident command center
  - Life support and critical supply storage
  - Computer server rooms
  - Telecommunications rooms
  - Narcotics storage
  - Medical records
  - Human resource records

- Rooms that contain cash. Consider locating devices that contain cash in an area that can be quickly secured.
- Pathology specimens
- Prosthetics
- Biohazards

- The room types listed below should include provisions to harden the room enclosure.
  - Central plant
  - Security office that houses main video feed, weapons, etc.
  - Storage for emergency supplies needed to move patients
  - Storage for emergency supplies needed to clear debris from a storm

  Ways to harden a room enclosure include these:

  - CMU enclosure walls that span deck to deck
  - Walls that meet requirements in Florida Building Code sections 1626.2, 1626.3, and 1626.4 or another Notice of Approval system
  - Wall and roof openings that meet requirements in ICC/NSSA 500: *Standard for the Design and Construction of Storm Shelters*
  - Other assemblies that are fortified to resist high winds
  - For a room that needs to be on the exterior, limited number of windows and, where windows are necessary, high-impact resistant glazing and frames
  - Location of emergency and surgery departments in areas either partially or fully protected by surrounding earth or on the north or northeast side of the building in regions where tornadoes typically travel from southwest to northeast. Consider locating the ambulance entrance and emergency department pedestrian walk-in entrance on the north or northeast side of the building as well.

- Consider locating an emergency supply storage area for patient and disaster readiness supplies in an area that is inherently hardened, such as a remote central energy plant.

Building envelope

The following components of the building envelope should be considered for tornado resiliency:

- **Roofing.** Consider providing one of the following types of roof assemblies:
  - Composite concrete metal roof with modified bitumen
  - Unballasted roof assembly
  - Other components that meet requirements in the *International Building Code* and ASCE-7: *Minimum Design Loads and Associated Criteria for Buildings and Other Structures*

- **Windows.** Consider these design details:
  - High-impact windows or windows that meet requirements in ICC 500 for high-acuity patient rooms and the emergency department
  - Tempered and laminated glass on all other windows
  - Impact-resistant gypsum board for spandrel glass
  - Safety film on windows in an existing facility or when the above recommendations do not fit into the budget for a new facility

- **Window frames.** Consider strengthened frames for high-acuity rooms, defend-in-place zones, safe zones, and the emergency department per the Miami/Dade design requirements.
- **Exterior doors.** Consider providing exterior doors that meet or exceed the requirements of ICC 500.

- **Exterior skin/curtain wall**
  - Consider use of the following options for exterior wall assemblies:
    - Assemblies that comply with Florida Building code requirements for high-velocity hurricane zones
    - Assemblies that comply with the missile criteria for tornado shelters in ICC 500
    - Assemblies of precast panels
    - For buildings with a penthouse, precast panel assemblies or an equivalent on exterior penthouse walls.
  - All exterior doors should be tested in accordance with missile impact and pressure test procedures in ICC 500.

Defend-in-place zones

Consideration should be given to means of hardening areas in the building that house patients who need to be defended in place.

- Areas in the facility where high-acuity patients can remain in place during an event should be identified in the DEVA. These locations may include intensive care units, neonatal and pediatric intensive care units, or other high-acuity departments serving patients for whom moving could be detrimental to their health.
- Defend-in-place zones should have the following provisions:
  - High-impact windows and frames or window assemblies that meet the requirements of ICC 500
  - Battery-powered lighting
  - Corridor wall assemblies that meet the structural integrity requirements for interior exit stairways in high-rise buildings in the *International Building Code*

Means of egress

If a building must be evacuated during an emergency event, certain

design features can facilitate safe patient relocation or transfer. Exit pathway construction, both horizontal and vertical components, should be strengthened to survive the power of a tornado. Exit pathway components include stairways, exit passageways, exit corridors, and other areas that could be used to relocate or transfer patients. Their construction should address the following:

- Strengthening of the entire enclosure. This may be achieved by use of one or a combination of the following:
  - Concrete masonry unit wall construction
  - Walls that meet *Florida Building Code* sections 1626.2, 1626.3, and 1626.4
  - Walls that meet another Notice of Approval system, as permitted by the *Florida Building Code*
  - Wall assemblies that meet the structural integrity requirements in the *International Building Code* for interior exit stairways in high-rise buildings
  - Other assemblies that are fortified to resist high winds
- Latching assemblies on cross-corridor doors in patient care units
- Battery-powered lighting at each landing in designated exit stairways

Utilities

A response to the potential loss of different utility services should be developed to prepare a facility for a tornadic event.

- Consider providing an uninterruptible power supply (UPS) for critical patient care units as a third level of redundancy.
- When the central utility plant is separate from the main health care facility, consider locating all utilities underground to prevent failure caused by high winds or debris. When utilities are underground, location of trees and root spread must be considered to ensure an uprooted tree will not disturb utility services.

- Consider providing secondary radio and communication systems in the event of power failure.
- Consider providing fire-rated plywood on walls of all electrical equipment and data rooms for added protection. The plywood should be mounted 12 inches above the finished floor and extend to at least 9 feet above the finished floor.
- Doors should be tested in accordance with the missile impact and pressure tests described in ICC 500.
- Consider providing an additional or heavy-duty anchor system for roof-mounted mechanical units and associated piping.
- Consider providing a permanent connection for portable generators on exterior walls.
- Battery-powered lighting should be provided in stairs, corridors leading to stairs, and critical patient units.

Incident command center.

At least one incident command center shall be provided for use of staff, community partners, and others involved in emergency management.

- The incident command center shall be permitted to be used for other purposes when not needed for emergency events.
- The incident command center should include redundant water, electricity, and HVAC systems and sanitation supplies or as prescribed in the DEVA
- The incident command center should provide a hardened enclosure as prescribed above.

Safe zones

Areas that could be used as a place to quickly relocate patients and staff during an emergency event should be identified. Any special design features needed for these safe zones should be determined during the emergency planning process.

- The DEVA should identify areas in the facility where patients,

staff, and visitors can be quickly relocated during an event. These could include corridors, interior suites, sleeping areas, treatment rooms, lounge or dining areas, or other low-hazard areas.

- Safe zones should have the following.
  - Space for not less than 30 net square feet per patient and 6 net square feet for each ambulatory person being relocated
  - Latching assemblies on cross-corridor doors in patient care units
  - Resilient windows as described above under the head "Hardening of key rooms and departments"

Other mitigation considerations

Listed here are additional built environment means that can reduce the severity of a tornado's impact on a facility.

- Verify that magnetic resonance imaging equipment has continuous power and a chilled water supply to avoid magnet quench.
- Identify and secure any locations with friable asbestos.
- Document the location of compressed gases and associated connections that could create a detrimental effect if damaged, and develop a plan to secure these areas during an emergency.
- Determine if any chemicals that could create adverse reactions are stored in the facility, and plan to secure such storage areas during an emergency.

During an Event

Listed are some steps for building components that are not automated and thus should be included in the emergency operations plan. Staff should be trained in these actions so they can implement them quickly as a tornado approaches.

- Secure the building, pharmaceuticals, medical records, and personal belongings of staff and patients.

- Shut down non-essential utilities.
- Implement residual UPS power for critical equipment.
- Relocate radioactive materials to an approved cabinet or equivalent location.
- Clear any unneeded items from exit paths.

After an Event

Recovery

The first task that should take place after a tornadic event is search and rescue. Once that has occurred, the health care organization should follow its emergency operations plan to determine how to treat current patients as well as incoming patients from the community in the safest and most responsible way possible.

Evaluation

Careful evaluation of the facility and of the staff response should occur after a tornadic event in order to determine what infrastructure failed and which procedures went as planned and which did not. If a system or equipment or an operational procedure failed, an investigation should be undertaken to determine why it failed. This should include an assessment of what can be done to prevent it from failing in the future.

Utility Outages

Before an Event

Outpatient and inpatient facilities must develop an alternative utility implementation plan or utility preparedness failure plan to prepare for an interruption in utility services. Such plans should address planning for both interruptions of short duration and extended interruptions or utility failures. The required uptime

availability (time and duration the building is expected to function) should be taken into account based on the facility type.

- For facilities that operate on a 24/7 basis (including for the duration of a weather or man-made event), the plan must indicate how the facility will continue to operate with the loss of each type of utility failure that could occur.
- For facilities that are not required to operate on a 24/7 basis but are expected to provide services during or immediately following a weather or man-made event, a plan must be developed for how the facility will operate with the loss of each type of utility failure that could occur.
- For facilities that are not required to operate on a 24/7 basis nor during a weather or man-made event, the health care organization must have a plan for how to operate after the event has passed.

The utility preparedness failure plan will include how use of alternative equipment can be accommodated to supplement or take the place of a failed utility service.

For extended duration utility failures associated with facilities that operate on a 24/7 basis, the plan must include an analysis of how to restore the facility to full capacity using a combination of fixed equipment in the facility (e.g., emergency systems) and supplemental equipment or measures that make it possible to provide fully functional operations to critical facilities during an extended utility failure.

For each type of utility failure addressed in the organization's utility preparedness failure plan, a duration for how long the facility can function without the utility should be established. This would include the estimated timeframe between utility failure and activation of the supplemental implementation plan as well as the restoration time needed to transition from the supplemental plan back to full functionality of the failed utility.

During an Event

If a weather or man-made event is forecast, the health care organization will have time to secure or reserve the resources and/or equipment needed to implement the utility failure preparedness plan. Resources (e.g., on-site fuel storage tanks, on-site domestic water tanks) to be added to a site or facility to support operation of permanently installed fixed equipment systems or to replace or supplement such equipment during a utility failure must be available for use when a utility failure occurs.

Supplemental systems that have been deployed or put into operation to support or substitute for a failed utility service must be continuously monitored while in operation, that is, until the failed utility has been restored and put back into service. To keep systems that will be required to operate continuously—even during an extended utility outage—in good working order, supplemental systems must also be employed so this equipment can be taken off-line for regular maintenance and service checks (e.g., multiple system configurations N+1, N+2, etc.).

During a utility outage, a health care organization may be required to modify systems based on best available equipment and/or products that can be sourced when an unexpected utility failure occurs. For these types of conditions, which fall into immediate response, temporary response, or semi-permanent response categories (refer to the modular construction chapter in this white paper for definitions and durations associated with each response type), the health care organization must implement a response plan in conjunction with its utility preparedness failure plan. This response plan may permit use of non-traditional equipment types, material types, installation methods, or system configurations. Consideration must be given to implementing such alternative solutions to provide services to a facility without compromising the design risk categories outlined in NFPA 99: *Health Care Facilities Code* or local AHJ life safety requirements.

After an Event

Restoring utility service

When all utility services have been restored and the utility company has demonstrated the system is online and functioning with the same reliability and capacity as before the outage, the facility management team restores the utility service as outlined in the utility failure preparedness plan for the facility. Any internal equipment that directly interfaces with the utility that failed must be analyzed to determine if the failure damaged any equipment and whether the equipment can safely be placed back into service. As well, it must be determined how long any standby supplemental equipment that provided service during the outage must remain on-site before it can be taken off-line or decommissioned.

Planning for the future

After all utility services are functioning as they did before, the health care organization must assess the policies and procedures in its utility preparedness failure plan. This analysis identifies which emergency preparedness systems, equipment, and preparedness measures were executed in accordance with the established plan and worked well and which could be improved based on lessons learned in preparing for the event, reacting during the event, and restoring service after the event. The facility utility preparedness failure plan should then be updated to reflect what was learned.

Wildfires

No location is completely free from the risk of wildfires, but historically they occur more commonly in the Western United States. The USDA Forest Service Modeling Institute has published a wildfire hazard potential map[5] to help organizations perform an initial vulnerability assessment related to wildfires. The wildfire hazard potential map is not intended to be used for forecasting or for a wildfire outlook for any individual season; rather, it is intended to support long-term planning.

Wildfires are unpredictable and greatly affected by wind and topography. They can occur at any time during the year, but the risks are elevated during periods of little or no rain. For a health care organization whose HVA has determined wildfires are a risk, it is important to have an emergency operations plan that is thorough and flexible. Refer to Appendix 4-3 for a case study on 2003 Southern California wildfires.

Before an Event

A disaster, emergency, and vulnerability assessment should be conducted as part of the safety risk assessment performed in planning a new health care facility or in determining how to protect an existing facility in the event of a wildfire.

Identify hazards from a wildfire

Identify all possible scenarios or events that could affect the health care facility during an active wildfire. Potential concerns include these:

- Poor air quality due to wildfire smoke
- Extended loss of power
- Inability of staff, patients, or supplies to reach the facility due to road closures
- Need for housing for staff who may have lost their homes due to the wildfire or who may not be able to leave the campus
- Potential need to evacuate the facility if engulfment by wildfire is imminent

Evaluate risks from identified hazards and generate mitigation solutions

Evaluate the scenarios or events identified and make plans to lessen their severity. Mitigation efforts could include items such as these:

- Maintain all air-handling unit filters.

- Commission/test air-handling unit control sequences.
- Maintain air-handling unit outside air damper actuators.
- Commission/test emergency generators.
- Develop a plan for housing staff on-site.
- Assign storage for N95 respirators and make sure the respirators are stocked ahead of an event.
- Establish and maintain a defensible space around the facility. A defensible space is an area around the building where landscaping, debris, and combustibles have been treated or cleared to reduce or slow the spread of fire. The space also serves as a buffer to give firefighters space to operate.
- Evaluate capacity levels of major infrastructure such as fuel oil, liquid propane, bulk oxygen, and medical gas bottles. Arrange for delivery prior to an event.

During an Event

In addition to the operational responses and information on temporary provisions in other chapters of this white paper, the following actions are appropriate to respond to a wildfire threat.

- Have additional maintenance workers available for an event.
- Assign staff members to fire watch with the responsibility of evaluating the interior and exterior site for early stages of fire.
- Consider closing outside air dampers to reduce the amount of smoke entering the facility. This action needs to be weighed against its impact on building and space pressurization.

After an Event

Recovery

Identify any actions required to return the facility to its original state. The following activities are often required to recover from a wildfire.

- Perform a thorough evaluation of the building and site with local officials.
  - Check the ground for hot spots or smoldering debris.
  - Check roofs, canopies, and exterior areas for embers.
- Clean up areas inside the facility that were affected by smoke and soot.
- Replace air-handling unit filters.
- Post-wildfire sites are more susceptible to landslides, erosion, and flooding due to the loss of vegetation and presence of bare ground. Work with experts on the best ways to restore and landscape impacted areas.

Evaluation

After the wildfire threat has passed, revisit the preventive analysis conducted using the DEVA to review the identified risks and mitigation solutions and evaluate how accurate the predictions were and how well the solutions worked. See the chapter on renovation and future facilities in this white paper for more information.

Resilient Facilities for Community Support

As with any community institution, such as a fire department, police department, or other local government agency, it is clear that health care facilities need to remain a vital source of reliability for residents and staff. Positive, proven direction must be given to ensure the safety of patients, staff, the physical structure, and continuity of service delivery.

This resiliency chapter provides suggested direction for health care organizations facing weather-related and man-made events. The content is based on committee expertise, experience during emergency events, and health care-driven physical environment changes needed for continuous delivery of safe, effective health

care during an emergency. Responses recommended for each of the emergency conditions covered in this chapter should be cross-referenced with the latest FEMA flood map for geography-driven events and governing codes in the health care facility's jurisdiction.

Resources

General

Centers for Disease Control and Prevention (CDC), "Natural Disasters and Severe Weather." https://www.cdc.gov/disasters/index.html

U.S. Climate Resilience Toolkit. https://toolkit.climate.gov

U.S. Department of Labor, Occupational Safety and Health Administration

- "Emergency Preparedness & Response." https://www.osha.gov/SLTC/emergencypreparedness/index.html
- "Evacuation & Shelter-in-Place." https://www.osha.gov/SLTC/emergencypreparedness/gettingstarted_evacuation.html

Other Relevant Standards

The following standards, where applicable, should be consulted for each event the health care organization determines could be a risk based on its HVA:

- ANSIASHRAE/ASHE Standard 170: *Ventilation of Health Care Facilities*
- ASCE/SEI 7: *Minimum Design Loads and Associated Criteria for Buildings and Other Structures*
- F*lorida Building Code* (FBC)
- ICC 500: *Standard for the Design and Construction of Storm Shelters*
- NFPA 70: *National Electrical Code*
- NFPA 72: *National Fire Alarm and Signaling Code*

- NFPA 99: *Health Care Facilities Code*
- NFPA 101: *Life Safety Code*
- NFPA 110: *Standard for Emergency and Standby Power Systems*
- NFPA 1600: *Standard on Disaster/Emergency Management and Business Continuity Programs*

Airborne Chemical, Biological, or Radiological Attacks

U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health. *Guidance for Protecting Building Environments from Airborne Chemical, Biological or Radiological Attacks*. Cincinnati, Ohio: NIOSH, May 2002. https://www.cdc.gov/niosh/docs/2002-139/pdfs/2002-139.pdf?id=10.26616/NIOSHPUB2002139

American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE). Report of Presidential Ad Hoc Committee for Building Health and Safety under Extraordinary Incidents on Risk Management Guidance for Health, Safety and Environmental Security under Extraordinary Incidents. Atlanta: ASHRAE, January 2003. https://www.ashrae.org/File%20Library/Technical%20Resources/Resiliance%20Activities/20053810917_347.pdf

Civil Unrest

Colling, R. L., and T. W. York. "Emergency Preparedness—Planning and Management." Chapter 24 in *Hospital and Healthcare Security*, 5th ed. Amsterdam: Elsevier, 2010.

U.S. Army Corps of Engineers (USACE); Protective Design Center; Security Engineering

U.S. Department of Defense; Unified Facilities Criteria (UFC) DOD *Security Engineering Facilities Planning Manual*; UFC 4-020-01

U.S. Department of Health and Human Services; Office of Assistant Secretary for Preparedness and Response (ASPR), Technical Resources, Assistance Center, and Information Exchange (TRACIE)

- "Civil Unrest During a Pandemic: Notes from Minneapolis." https://files.asprtracie.hhs.gov/documents/aspr-tracie-civil-unrest-during-a-pandemic-notes-from-minneapolis.pdf
- Hospitals and civil unrest resources. https://files.asprtracie.hhs.gov/documents/aspr-tracie-ta-hospitals-and-civil-unreset-resources--6-1-2020.pdf

U.S. Department of Veterans Affairs, *VA Physical Security and Resiliency Design Manual*; latest edition (current posted is 2015; new scheduled to be published 10/2020)

Hurricanes and Flooding and Sea Level Rise

Federal Emergency Management Agency

- FEMA Flood Maps. https://www.fema.gov/flood-maps
- Building Science—Hurricane Publications. https://www.fema.gov/emergency-managers/risk-management/building-science/hurricanes

International Code Council. Section 202 Definitions; Chapter 4, Special Detailed Requirements Based on Use and Occupancy; Chapter 14, Exterior Walls; Chapter 15, Roof Assemblies and Rooftop Structures; and Chapter 16, Structural Design in *Florida Building Code* (ICC, 2020).

National Weather Service (NWS) and National Oceanic and Atmospheric Administration (NOAA), National Hurricane Center. https://www.nhc.noaa.gov

U.S. Climate Resilience Toolkit. "After Katrina, Healthcare Facility's Infrastructure Planned to Withstand Future Flooding." https://toolkit.climate.gov/case-studies/after-katrina-health-care-facilitys-infrastructure-planned-withstand-future-flooding

Superstorm Sandy Reports

American Institute of Architects New York Chapter, Post-Sandy Initiative. "Building Better, Building Smarter—Opportunities for Design and Development (May 2013). http://postsandyinitiative.org/

New York State Department of Health; Public Health and Health Planning Council, Ad Hoc Advisory Committee on Environmental and Construction Standards. "Final Report and Recommendations" (October 2013). https://www.health.ny.gov/facilities/public_health_and_health_planning_council/environmental_and_construction_committee/docs/adhoc_e_and_cs_committee_final_report.pdf

PlaNYC. "A Stronger, More Resilient New York" (June 2013). https://www1.nyc.gov/site/sirr/report/report.page

Urban Green Council (New York Chapter of the U.S. Green Building Council), Building Resiliency Task Force. "Report to Mayor Michael R. Bloomberg & Speaker Christine C. Quinn" (June 2013). https://www.urbangreencouncil.org/sites/default/files/2013_brtf_summaryreport_0.pdf

U.S. Department of Health and Human Services, Office of Inspector General. "Hospital Emergency Preparedness and Response During Superstorm Sandy," Report OEI-06-13-00260 (September 2014). https://www.oig.hhs.gov/oei/reports/oei-06-13-00260.asp

Pandemics

Centers for Disease Control and Prevention (CDC), National Pandemic Strategy. https://www.cdc.gov/flu/pandemic-resources/national-strategy/

Eppstein Uhen Architects. "Pandemic Considerations for Health Facility Design." eua.com, May 2020 (updated August 2020). https://www.eua.com/media/8861/covid-19-planning-impacts.pdf

Tornadoes

National Institute of Standards & Technology. "Final Report: Technical Investigation of the May 22, 2011, Tornado in Joplin, Missouri." NIST NCSTAR 3. (U.S. Department of Commerce, March 2014). http://dx.doi.org/10.6028/NIST.NCSTAR.3

Utility Outages

California Emergency Medical Services Authority. "Incident Planning Guide: Utility Failure." https://emsa.ca.gov/wp-content/uploads/sites/71/2017/07/Utility-Failure-IPG.pdf

Centers for Disease Control and Prevention and American Water Works Association. *Emergency Water Supply Planning Guide for Hospitals and Healthcare Facilities*. Atlanta: U.S. Department of Health and Human Services; 2012. Updated 2019. https://www.cdc.gov/healthywater/emergency/pdf/emergency-water-supply-planning-guide-2019-508.pdf

Federal Emergency Management Agency. "Healthcare Facilities and Power Outages: Guidance for State, Local, Tribal, Territorial, and Private Sector Partners" (August 2019). https://www.fema.gov/sites/default/files/2020-07/healthcare-facilities-and-power-outages.pdf

Manto, Charles, et al. *Resilient Hospitals Handbook: Strengthening Healthcare and Public Health Resilience in Advance of a Prolonged and Widespread Power Outage*. (Federal Bureau of Investigation InfraGard and Electromagnetic Pulse Special Interest Group). https://www.empcenter.org/wp-content/uploads/2017/09/CF_Resilient_Hospitals_Handbook_edits-cm_Version3b2.pdf

Stymiest, David L. "Best practices for hospital power system reliability: Advice for planning, design, installation, inspection, maintenance and more." *Health Facilities Management* (March 2, 2018). https://www.hfmmagazine.com/articles/2089-best-practices-for-hospital-power-system-reliability

U.S. Department of Health & Human Services, Healthcare & Public Health Sector Coordinating Councils. "Planning for Power Outages: A Guide for Hospitals and Healthcare Facilities." https://www.phe.gov/Preparedness/planning/cip/Documents/healthcare-energy.pdf

Wildfires

U.S. Department of Agriculture, U.S. Forest Service. Fire, Fuel, Smoke Science Program, Rocky Mountain Research Station.

"Wildfire Hazard Potential." https://www.firelab.org/project/wildfire-hazard-potential

Endnotes

1 The Emergency Conditions Committee determined that seismic codes provide appropriate guidance on earthquakes. Therefore, earthquakes are not addressed in this white paper.

2 National Oceanic and Atmospheric Administration, National Hurricane Center, "Sea, Lake, and Overland Surges from Hurricanes," accessed March 13, 2021, https://www.nhc.noaa.gov/surge/slosh.php.

3 FEMA Flood Maps, https://www.fema.gov/flood-maps.

4 NOAA National Centers for Environmental Information, "State of the Climate: Tornadoes for Annual 2019," published online January 2020, accessed March 14, 2021, https://www.ncdc.noaa.gov/sotc/tornadoes/201913.

5 U.S. Forest Service Fire, Fuel, Smoke Science Program, Rocky Mountain Research Station., "Wildfire Hazard Potential," accessed March 14, 2021, https://www.firelab.org/project/wildfire-hazard-potential.

Proposed Language Based on the 2018 Hospital *Guidelines*

The proposed new language below shows changes to the 2018 FGI *Guidelines* recommended by the weather and man-made event resiliency subcommittee of the Emergency Conditions Committee. Additions are underlined, and deletions indicated with a ~~strikethrough~~. Where an appendix item (i.e., a non-enforceable recommendation or guidance on applying a requirement) has been provided, an asterisk (*) precedes the section number (e.g., *1.2-4 Safety Risk Assessment). Appendix items can be identified by the letter "A" that precedes the correlating section number (e.g., A1.2-4 SRA). The text shown has been excerpted from the 2018 *Guidelines* and is not comprehensive. These proposed changes have been adapted and incorporated with recommended changes from other subcommittees in the draft *Guidelines for Emergency Conditions in Health and Residential Care Facilities* in the last section of this white paper.

***1.1-2 New Construction**

Projects with any of the following scopes of work shall be considered new construction and shall comply with the requirements in the Guidelines for Design and Construction of Hospitals:

> **A1.1-2 Resiliency in new construction.** Incorporation of design considerations for resiliency should be required for new construction where continuity of patient care services is required in the event of an emergency. Refer to Section 1.2-4.9 (Disaster, Emergency, and Vulnerability Assessment) for applicability.

1.1-3 Renovation

1.1-3.1 General

1.1-3.1.1 Compliance Requirements

*__1.1-3.1.1.1__ Where renovation or replacement work is done in an existing facility, all new work or additions or both shall comply with applicable sections of the *Guidelines* and local, state, and federal codes.

> **A1.1-3.1.1.1 Resiliency in renovation projects.** Incorporation of design considerations for resiliency should be required when renovating an existing facility or where continuity of patient care services is required in the event of an emergency. Refer to Section 1.2-4.9 (Disaster, Emergency, and Vulnerability Assessment) for applicability.

2.1-6.3.6 Incident Command Center

At least one room that can be used as an incident command center shall be provided in the hospital.

2.1-6.3.6.1 This room shall meet the following requirements:

(1) It shall be sized to provide the number of seats necessary for all critical positions stipulated in the Hospital Incident Command System (HICS) structure.

(2) It shall be located to allow access at all times or as necessary per the disaster, emergency, and vulnerability assessment (DEVA).

(3) Provisions shall be made to ensure a controlled environment for occupant comfort.

(4) Provisions shall be made for emergency power capabilities in the room as required in Article 708 (Critical Operations Power Systems) in NFPA 70: *National Electrical Code*.

(a) All systems required to carry out orders and maintain continuity of service shall be on the emergency power system.

(b) The ventilation system for the room shall be on emergency power to provide continuous service.

(5) Provisions shall be made to support cell phone and first responder radio transmission communications.

2.1-6.3.6.2 At least one additional room shall be provided immediately adjacent to the incident command center.

2.1-6.3.6.3 Provisions shall be made for emergency supply storage immediately adjacent to the incident command center. The amount of storage shall be determined by the DEVA.

2.1-6.3.6.5 Use of this room for another purpose shall be permitted when it is not in use as an incident command center.

Chapter 5: Renovation and Future Facility Design

In light of the COVID-19 pandemic and the increased prevalence of severe weather events, health care organizations building new facilities or renovating existing ones will want to consider how best to prepare for their organizational response to emergency conditions that may arise in their locale in the future.

The Standard Design Approach

Despite the number of infectious disease outbreaks that have reached the United States in the 21st century, including SARS; Ebola; the H1N1, swine, and avian flus, the design of most U.S. hospitals has continued to reflect the misconception that infectious patients are a rarity. The attitude has largely been "it does not happen here" and, even if an infectious disease did emerge, the numbers were expected to be small, the ability to quarantine prompt, and any possible spread minimal.

When Ebola appeared in the United States in 2014, its relative rarity preempted a national reaction and resulted in minimal and sporadic regional responses. Designated Ebola units were created at hospitals in some metropolitan areas to care for a small number of patients, saving other facilities from the need to replicate that capability.[1] There was no anticipation of an event that would cause the numbers of patients with an infectious disease to rise beyond dozens locally, let alone into the hundreds of thousands nationally.

Reflecting this outlook, requirements in the FGI *Guidelines* historically were crafted on the common assumption that most patients would be ill or injured, with only cursory consideration given to the design implications if many patients were possibly infectious. The primary *Guidelines* response to the need for spaces to care for infectious patients has been the requirement for an airborne infection isolation (AII) room, which has appeared in the document since at least the 1987 edition. As occurrences of health care-associated infections (HAIs) increased, a corresponding focus on infection prevention (beginning with heightened requirements for safe construction introduced with the infection control risk assessment in the 1996–97 edition) influenced more recent editions. Nonetheless, to date the *Guidelines* has not included design requirements for infectious disease units or biocontainment units that would allow hospitals to respond to a widespread infectious disease outbreak.

The COVID-19 global pandemic revealed that most health care organizations are ill-equipped to absorb a sudden surge of infected and potentially infectious patients into the existing hospital network. Without the infrastructure needed to accommodate appropriate mechanical (HVAC) and staffing requirements during a surge of infectious patients, most organizations found it difficult to adapt their facilities beyond "as-designed" patient volumes. During the pandemic, the sheer number of emergent patients requiring isolation, equipment, and intensive care nursing commitment overwhelmed available resources.

The recommendations and proposed changes to the FGI *Guidelines* text outlined in this chapter focus on maintaining a safe facility for

care of all patients while responding to large numbers of known or suspected infectious patients. As many of these recommendations have not benefited from the test of time essential to prove efficacy, only a few can be considered basic or universally applicable. These basic items may already appear in the FGI *Guidelines* or are presented as proposals to change the *Guidelines* at the end of this chapter. However, recommendations noted as "enhanced" and "advanced" have been considered and even implemented by some health care organizations. Widespread endorsement of these recommendations will require evidence of effectiveness that is not yet available. For now, determining which recommendations to implement for a specific facility will be left to the discretion of the governing body and the outcome of their hazard vulnerability assessment (HVA), an annually reviewed self-assessment of a health care organization's vulnerabilities required by the Centers for Medicare & Medicaid Services (CMS), and a disaster, emergency, and vulnerability assessment (DEVA) performed as part of the safety risk assessment process in planning new construction and renovation projects. (See Chapter 1 in this white paper for information about the DEVA.)

Subcommittee Approach and Process

To help health care organizations address a broader range of emergency conditions than had previously been considered in the *Guidelines*, the subcommittee on renovation and future facilities reviewed current *Guidelines* language and developed recommended revisions and new elements based on the 2018 Hospital and Outpatient documents.

The result is a list of recommendations for elements that increase the ability of an institution to accommodate episodic epidemic/pandemic emergency conditions and a series of proposals to modify the 2018 *Guidelines* text. The rationale for including an element, its impact on longer term organizational flexibility, and possible operational concerns were considered. The recommendations have been overlaid with a filter to indicate their priority for implementation: basic (required for renovations or future facility projects), enhanced

(benefit may outweigh greater cost), or advanced (discretionary at the direction of the governing body as noted above).

The group began by establishing these guiding questions:

1. Where does the 2018 *Guidelines* stand in regard to defining criteria for facility spaces and infrastructure that will not only support safe patient care and workplace considerations, but also reflect the direct influence of emergency condition resilience/surge strategies? What improvements are warranted?
2. Can decision-making for new construction and renovation projects be tied to a risk assessment to determine whether inclusion of any elements beyond the basics is justified by the likelihood and level of impact on property and lives from particular emergency conditions?

A thorough review of current *Guidelines* language in the common elements chapters of both the 2018 Hospital and 2018 Outpatient documents was undertaken. Common elements, by their nature, apply across all the facility type chapters in the *Guidelines* documents, and any recommendations regarding material in these chapters would have the broadest range of facility ramifications. Recommendations for changes were organized by section and written into formal proposals to modify language in the 2018 *Guidelines*.

Interviews were conducted with a variety of health care organizations to determine actions taken leading up to their peak patient loads at the beginning of the pandemic and in subsequent months as volumes and surge conditions fluctuated. "Best practice" and "common response" approaches were collected and used to develop proposals for *Guidelines* modifications for public comment and eventual adoption.

In addition, the subcommittee considered several "step-up" scenarios in which outpatient facilities could serve alternative uses during emergency condition events. These led to recommendations addressing surge capacity or alternative uses of outpatient facilities.

Development of Recommendations to Address Emergency Conditions when Planning New Construction and Renovation Projects

To support planning and design for physical environment responses to emergency conditions in newly constructed health care spaces, the subcommittee strove to determine how to introduce new topics or expand information currently in the *Guidelines*.

Planning for Primary Facility Responses in an Emergency

Emergency conditions tend to drive two broad facility responses: increasing surge capacity and facility hardening/resiliency (see Chapters 2 and 4 of this white paper for more information on these responses). Both have physical environment implications that should be considered in planning new construction and renovation projects.

Hardening

Strategies for hardening—enhancing a facility's ability to withstand, endure, and recover from physical damage—are primarily applicable to physical events (e.g., flooding, tornadoes, earthquakes, wildfires, explosions, civil unrest). Most strategies in this category are covered in relevant building codes, and the subcommittee did not consider items of resilience or hardening already addressed through other agencies and/or adopted codes.

Rather, the subcommittee studied events not specifically addressed in other codes and developed recommendations for changes to the *Guidelines* that are based on actual responses to past events. Recommendations were developed that support safe operations before, during, and after such events; these require the health care organization to conduct a DEVA to determine which are applicable to its facility risks.

Two key takeaways related to hardening from the subcommittee's review are (1) planning for up to 96 hours of utility interruption must also address interruption of the water supply and medical gases, not just of heating or electrical distribution (which are currently addressed by code), and (2) risks to the facility from internal piping damage must be considered.

The group's findings related to hardening can be summarized as follows:

- Resilience and hardening related to preparation for emergency conditions that cause physical damage to buildings or infrastructure are generally already covered in codes published by the International Code Council; National Fire Protection Association (NFPA); ASHRAE; and other organizations, as well as licensing bodies such as the Joint Commission. Emergency conditions addressed by these groups include floods, earthquakes, hurricanes, prolonged heatwaves, and arctic cold.
- Recent instances of some emergency conditions have given rise to new best practices in hardening. Some of these have emerged as basic design elements the subcommittee recommends adding to the *Guidelines*.
- An organization's response to evolving emergency conditions such as civil unrest/crowd control or an active shooter should continue to be reviewed over time to identify successful facility responses.

Surge capacity

A facility can exceed its licensed occupancies in two ways: from a sudden influx of patients (a "big bang" or mass casualty event) or in a gradual buildup of census (a "rising tide" event, such as a pandemic or seasonal influenza). Surge is also characterized by its anticipated duration—immediate/short, seasonal, long-term, or indeterminate.

The need for health care providers at many levels to be prepared for mass casualty incidents and surges in patient population has been

mandated by CMS and included in standards from organizations such as NFPA and FGI.

It is important to evaluate potential surge needs early in project planning. Thus, planning for new construction and renovation projects should be based on a DEVA unique to each campus and location. In particular, consideration must be given to components of the built environment (e.g., mechanical, electrical, medical gas, access control infrastructure) that may seem less obvious but may provide the most surge flexibility outside of temporary structures.

Examples of what to consider during planning include design solutions that will support provision of temporary testing/triage sites outside the facility or in a parking structure, modification of airflow to create whole "infectious isolation" units, use of the post-anesthesia care unit (PACU) for critical care patients, and rapid completion of any "shelled" portions of the facility.

Planning Considerations to Support Emergency Response

The subcommittee adopted a specific perspective to help formulate recommendations: "Assume *everyone* could be infected and infectious [airborne, droplet, and contact modes of transmission]." However, these recommended responses can be reviewed with the particulars of any relevant emergency condition in mind.

To prepare for emergency conditions, the responses discussed here should be assessed by the health care organization and their implementation planned for health care facilities where appropriate.[2,3] Considerations for each response are as follows:

Space for screening

Although screening may not identify patients who are infected but asymptomatic, it is a common first step in regulating traffic into a building during a pandemic.

- Screening requires space, supplies, and often power, water, and data.
- Screening may involve specimen acquisition and/or on-the-spot point-of-care testing.
- Point-of-care service requires space for testing equipment, staff activities, and supplies to support operational processes.

Accommodations for waiting and queuing

In a surge event, waiting rooms may not be large enough to accommodate the number of incoming patients, especially during an airborne/droplet disease epidemic or pandemic. Instead, something like cell phone lots at airports will be safer. Consider whether site design will make valet parking practical during a pandemic. Robotic high-density parking strategies and self-parking may be preferred in certain situations.

Space for physical distancing

Because physical distancing is recommended to limit the spread of airborne or droplet-transmitted infection, means should be identified to allow increased distance between individuals in traditionally densely occupied spaces during an epidemic or pandemic. This could take the form of increasing the square footage per person when planning the size of certain spaces (e.g., conference rooms, waiting areas, atria, dining facilities, staff support areas) for new construction or renovation projects. An operational solution for existing spaces is to reduce the number of people permitted in a space at any given time.

Ventilation[4]

In cases of airborne disease, spaces where infected patients are cared for should be ventilated with 100 percent outside air (filtered) in high quantities (flushing velocity, increased air changes per hour). This can be achieved by designing and building the air-handling system with the capability to convert to 100 percent economizer mode and the ability to increase supply airflow to achieve increased requirements for air changes per hour when necessary. Return air would be relieved to the outdoors rather than recirculated. This

ventilation protocol should remain in effect until the last patient has been discharged and cleaning of the space is complete.

Moving air in a one-way direction from the supply source, past the user, to exhaust (unidirectional flow concept) is preferred over turbulent airflow conditions in patient care areas (e.g., exam, procedure, patient rooms).

Negative airflow (air moving from general access spaces toward an infectious patient rather than vice versa) helps limit the spread of infection to adjacent users and improves safety for those outside the patient care area. In addition to any room where patients receive care, this applies to dedicated waiting areas for infectious patients.

Availability of PPE and means for hand-washing and sanitizing

Personal protective equipment (PPE) should be readily available to staff, with storage and distribution to foster this included in project planning and design. In addition, space for donning, doffing, and disposing of PPE at room entrances/exits is critical to the effective use of PPE. Means for hand-washing and sanitizing should be easy for staff to access.

Flexible design

Flexibility should be employed in design to allow for modification over time or in the event of an emergency condition. For example, design and placement of seating and desks in workspaces or seating and fixtures in cafeterias could support use of these spaces for patient care in an emergency. Patient care area designs that minimize staff exposure to infection (e.g., through-wall connections for IV pumps and monitors that enable staff to monitor patients without entering the patient room) should be considered.

Surfaces that can accommodate heavy cleaning

Cleanability of surfaces should be the first criterion for selection of surface materials so they will hold up under the health care organization's sanitizing practices. However, built environment

solutions alone cannot ensure safety; compliance with infection prevention and cleaning protocols is also needed to assure a safe care environment.

Some health care organizations are incorporating new sanitizing equipment (e.g., mobile germicidal ultraviolet robots, mobile hydrogen peroxide vapor robots), used after manual cleaning of surfaces has taken place, into their cleaning protocols. Where these new tools are used, their storage implications must be carefully considered along with the required safety measures specific to each system.

Support areas for increased environmental services activity

Public spaces will require environmental services staff to be continuously present (think airport concourses). Larger environmental services areas will be needed to support these roving environmental services teams. The service areas should be distributed as needed to support frequent cleaning cycles and use of new equipment like mobile UV robots.

Storage for disposable supplies and/or reprocessing/ cleaning facilities for reusable items

Almost everything used to treat patients during a pandemic (e.g., gowns, curtains, exam table coverings) is disposable and requires storage (e.g., centralized storage for bulk, distributed storage for point-of-use carts positioned for intermittent needs). As well, readily achievable options for disinfecting, sterilizating, and reprocessing items that are not disposable, including staff scrubs if contaminated gear is not taken out of the hospital, should be available on-site.

Touchless equipment operation

Equipment that can be operated without touching is preferred. Consideration should be given to using automated, RFID-triggered, and voice-activated systems.

Accommodations for patient self-check-in

Self check-in and self-rooming concepts make it possible to limit face-to-face encounters between patients and staff. This can be achieved via virtual connections, remote access, and online chat functions; provision of space to use and store this technology should be considered.

A Note About Development of the Emergency Response Recommendations for Building Projects

All considerations mentioned for facility modification and design to respond to emergency conditions have been developed following rapid prototyping of spontaneous responses during the onset of the COVID-19 pandemic or lessons learned following recent weather-related emergencies (e.g., hurricanes Sandy and Katrina). Many of these items will be codified in subsequent editions of the *Guidelines*, while others will be found in future FGI Beyond Fundamental documents and could be considered aspirational.

The FGI *Guidelines* currently assumes most health care organizations will serve patients with noncommunicable disease or address conditions where infection prevention and staff safety concerns are standard rather than heightened. For design of new facilities, basic recommendations have been built from lessons learned in line with this FGI common denominator strategy and an eye to enforceability by licensing authorities. Also developed were elements that support surge needs and adjust the availability of facility amenities that can help address ongoing complications in providing patient care due to infectious disease proliferation.

Development of Design Recommendations: Basic, Enhanced, and Advanced

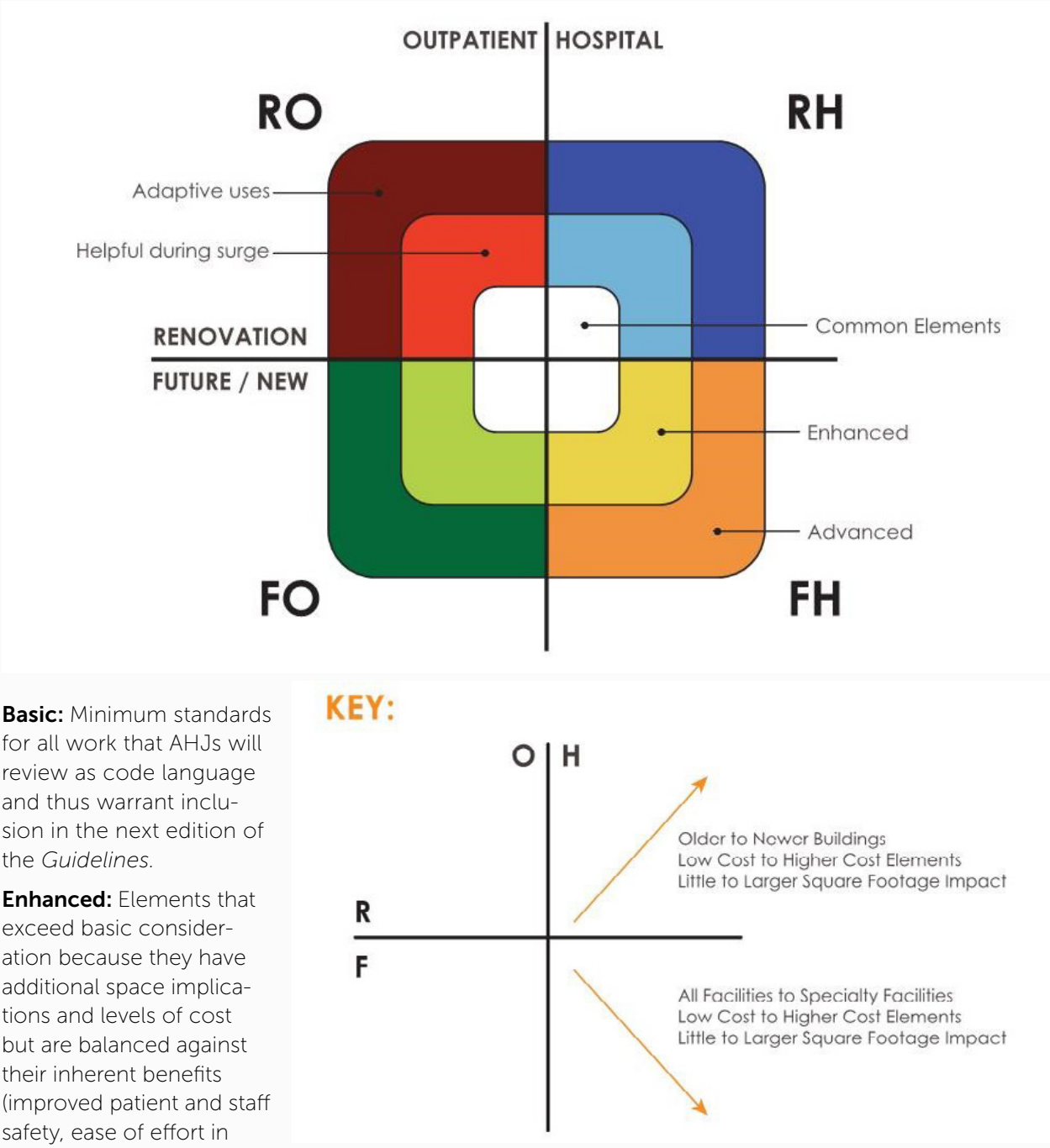
As indicated above, the subcommittee's recommendations for modifying the *Guidelines* language to help health care organizations and designers develop facilities that are prepared for emergency response have been broken into three categories. The subcommittee used tables, organized by relevant *Guidelines* chapters, to compile identified physical elements that support responses to emergency conditions, each with an indication of application expectations and relevant drivers for consideration. As well, each element was flagged as basic, enhanced, or advanced, as described below.

Basic

Basic recommendations are those elements that warrant inclusion in the next edition of the *Guidelines* and represent new minimum standards for all work reviewed by authorities having jurisdiction (AHJs) (both renovation and new construction projects) as code ("shall") language. Most basic elements apply to all health care facilities, for both hospital inpatient and outpatient populations. Basic items also reflect lessons learned from the influx of infectious patients (COVID-19 or other) as well as a new appreciation for the impact of and potential for airborne/droplet disease recurrence.

It is the subcommittee's recommendation that health care organizations implement all basic elements. For existing facilities, these modifications will likely take place over time unless the DEVA process indicates a high likelihood of occurrence for emergency conditions that would result in severe harm if the modifications were not made. For future facilities, the subcommittee's intent is for these basic elements, if not already in the *Guidelines*, to be embedded as new text in the 2022 edition, hence their inclusion as proposals for change at the end of this chapter.

Figure 5-1: Emergency Condition Response Levels



Basic: Minimum standards for all work that AHJs will review as code language and thus warrant inclusion in the next edition of the *Guidelines*.

Enhanced: Elements that exceed basic consideration because they have additional space implications and levels of cost but are balanced against their inherent benefits (improved patient and staff safety, ease of effort in responding to an emergency, speed of implementation, and increased surge capacity).

Advanced: Robust solutions provided at large scale that aggregate many basic and enhanced elements. These items may be thought of as "beyond fundamental" and as such may be discretionary.

Enhanced

Enhanced recommendations are elements that involve additional levels of cost and spatial impact compared to the basic elements. These increased cost/space implications are balanced against the inherent benefits of improved patient and staff safety, ease of implementation, speed to implementation, and increased capacity for significant high-impact emergency conditions. These initiatives may be considered for a minimal number of select facility locations rather than for all health care facilities. A health care system might choose to cluster enhanced response solutions in specific facilities or portions of facilities as hubs for their system's emergency response efforts. For example, during the COVID-19 pandemic, one health care organization created a hub in their ICU building to treat COVID-19 patients.

Implementation of enhanced elements would be considered if the risk assessment and governing body's evaluation of mission, vision, and values indicate it is warranted.

Advanced

The advanced recommendations represent the most robust solutions at a larger scale and aggregate many of the recommended elements as one response decision. Health care organizations with a tertiary or quaternary level of patient destinations may choose to justify implementation of these items as a reflection of their emphasis on teaching, research, innovation, or excellence.

The decision to implement enhanced and advanced elements is at the discretion of the governing body, which can rely on a DEVA to identify which elements should be considered.

Emergency Response Recommendations for New Construction and Renovation Projects

Note: Any ventilation proposals included will require coordination with and may require modifications to ASHRAE 170: *Ventilation of Health Care Facilities*, which lies outside the purview of the Facility Guidelines Institute.

General

1. *[Basic]* Use the disaster, emergency, and vulnerability portion of a safety risk assessment or an evaluation decision tree to identify the health care organization's risks from emergency conditions and desired levels of preparedness. Not every facility needs to achieve the same level of resilience. Facilities needed for normal operations vs. surge operations (mass influx for any reason) vs. an infectious outbreak (e.g., SARS, COVID-19, flu) should be assessed. See the chapter on risk assessment in this white paper for more information.
2. *[Basic]* Determine storage needs for emergency response and how they will be met. On-site storage is recommended for PPE. Temporary structures (e.g., tents) with a screening enclosure can be used. Storage for bulk supplies to mitigate supply chain disruption is advisable. Off-site warehousing may be useful, but access to such locations during an emergency should be considered (see the resiliency chapter in this white paper).
3. *[Basic]* Develop building entry screening protocols and identify space requirements for implementing them, indicating which would be temporary and which would be permanent.
4. Identify how temporary space would be provided for donning and doffing PPE wherever staff will care for infectious patients. This could be an anteroom, ICRA barrier configuration, department, or building that is separate from other activities.
    - *[Basic]* Provide sufficient space in donning and doffing zones to allow for separation between areas for donning clean PPE and doffing dirty PPE.
    - *[Enhanced]* Provide distinct spaces for donning and for doffing PPE.

5. *[Basic]* If an anteroom is not provided for airborne infection isolation (AII) rooms in the facility, determine how a temporary comparable space could be added during an emergency.
6. *[Enhanced]* Design all new AII rooms with an anteroom.
7. *[Basic]* Provide increased numbers of changing areas, showers, and on-call amenities for staff.
8. *[Basic]* Develop physical distancing criteria to support a safe workplace during an epidemic or pandemic.
    - Determine the number of people per square foot that will be permitted for staff group spaces and designate locations where these restrictions will apply. The COVID-19 pandemic required six feet of separation, but this may not be appropriate for other epidemics.
    - Identify opportunities for segregating public entry/exit points from staff entry/exit points.
9. *[Basic]* Develop PPE/hand-washing expectations for non-patient care settings during an epidemic or pandemic and determine how the physical environment can support these.
10. *[Basic]* Identify a location for an incident command center (e.g., an existing boardroom) and several alternative locations as part of planning criteria.
11. *[Basic]* Identify any large gathering spaces in the planned project that could be converted to support surge needs (e.g., ward bed configuration with sufficient power, access to data and medical gases, and the potential for air quality [HVAC] enhancements). Determine what design elements would need to be provided to facilitate bringing these spaces online during an emergency.
12. Provide access to at least one operating room (OR) with an anteroom to allow for the ongoing surgical needs of infectious patients.
    - *[Basic]* Use temporary ICRA barrier construction methods to provide an anteroom.
    - *[Enhanced]* Add an anteroom to a single existing OR.

- *[Advanced]* Provide multiple ORs that use a common anteroom or individual anterooms for each OR as recommended by the DEVA to address surge needs.

13. *[Enhanced]* Identify patient care spaces that can be used during a pandemic to serve as isolation spaces, noting that use of these spaces would not trigger individual toilet room requirements.

14. *[Enhanced]* Design pre/post-procedure patient care areas (e.g., PACU) so patient care stations can be used as intensive care beds. See the surge chapter in this white paper for more information.

Emergency Department

15. *[Basic]* Determine how external triage expectations will be met and plan space and actions needed to implement the agreed-upon approach. What will be done before patients enter a facility? What infrastructure will be needed outside the building (e.g., power, water, data requirements)?

16. *[Enhanced or Advanced]* Consider designing the emergency department HVAC system to allow air/exhaust compartmentation to separate ill patients from injured patients (and, in a pandemic, symptomatic from asymptomatic patients). Essentially, this concept reflects current smoke compartmentation strategies employing dampers and separate supply and return air ducting and mechanical units.

Patient Care Units

17. *[Basic]* Consider means for providing visibility to patient rooms from the corridor via remote monitoring or view panels in doors/walls. Also consider providing a connectivity port through the wall to permit placement of equipment that must be monitored in the hall rather than in the patient room.[5]

18. *[Basic]* Airborne infection isolation rooms should be able to accommodate provision of dialysis.

19. *[Basic]* In intensive care units that don't have satellite nurse workstations between rooms, consider providing sufficient space in the corridor to set up a nurse workstation outside the room to reduce staff exposure and decrease use of PPE.[6]

20. *[Enhanced or Advanced]* Design all patient rooms to be capable of

accommodating a second patient during a surge event. Minimum criteria would be sufficient space for bed distancing, medical gas sharing, and provision of the number of electrical receptacles and medical gas station outlets for an intensive care room.

21. *[Enhanced or Advanced]* Design the HVAC system so the number of air changes can be managed through the building management system. This would make it possible to easily increase air changes per hour when needed during a pandemic or epidemic.

22. *[Advanced]* Plan for all patient rooms to have the ability to shift from neutral to negative pressure, perhaps using a self-contained suite approach based on life safety compartmentation.

Determining When Emergency Condition Recommendations Apply

When a health care organization is deciding which emergency conditions it should prepare for and what level of preparedness it should implement, risk assessment tools are an important part of the process. The HVA and DEVA mentioned at the beginning of this chapter, and covered in depth in Chapter 1 in this white paper, are intended to help health care organizations make these determinations.[6]

Common levels of preparedness are hardening, resilience, provision of additional space, ability to readily expand surge capacity, and operational readiness, including availability of equipment/supplies and staff preparedness.

Once relevant emergency conditions and level of preparedness have been determined, an all-hazards approach to determining which elements to implement is suggested to generate the broadest set of facility implications per location.

It is reasonable to assume that not every health care facility will need to meet 100 percent of the resiliency/hardening recommendations outlined here and in other chapters in this white paper. Rather

than anticipating uniform application of all elements across all facilities, the risk assessments should be conducted for each facility, often within the framework of a health care organization's overall readiness plan (choosing specific facilities from a variety of possible locations) or a regional emergency response plan (state or local jurisdictions may want particular resources to be centralized for the benefit of all).

When considering the levels of preparedness appropriate for a particular facility, the following considerations should be reviewed and implications understood:

- Each emergency condition drives a particular response profile (e.g., construction type/details, space needs, flows/configuration). Many emergency conditions require layers of response across multiple categories. Also, many emergency responses correspond to multiple categories, and these "across the board" elements (i.e., the basics) should be strongly recommended and prioritized for implementation.
- Existing facilities can be retrofitted if particular emergency conditions have a high likelihood and consequence and the organization can tolerate the new layers of modification proposed. These specifics could be addressed in a targeted renovation project or as part of a broader renovation of the facility.
- New facilities can accommodate additional design criteria if the criteria are articulated, measurable, enforceable, and affordable.

For each existing or future facility, all hazards likely to affect the facility that can be mitigated by the physical environment, or that the physical environment can support a response to, should be identified. Then a plan should be developed to implement the recommended elements that respond to these hazards as part of renovation or new construction projects.

Recommendations for Renovation Projects

In determining which recommendations can be addressed through a renovation project, the risk assessments for each existing hospital and outpatient facility in a health care system should be reviewed. A list of modifications for relevant scope and timeframes for implementation can be prioritized for each facility. To help assess the recommended actions, consider the following:

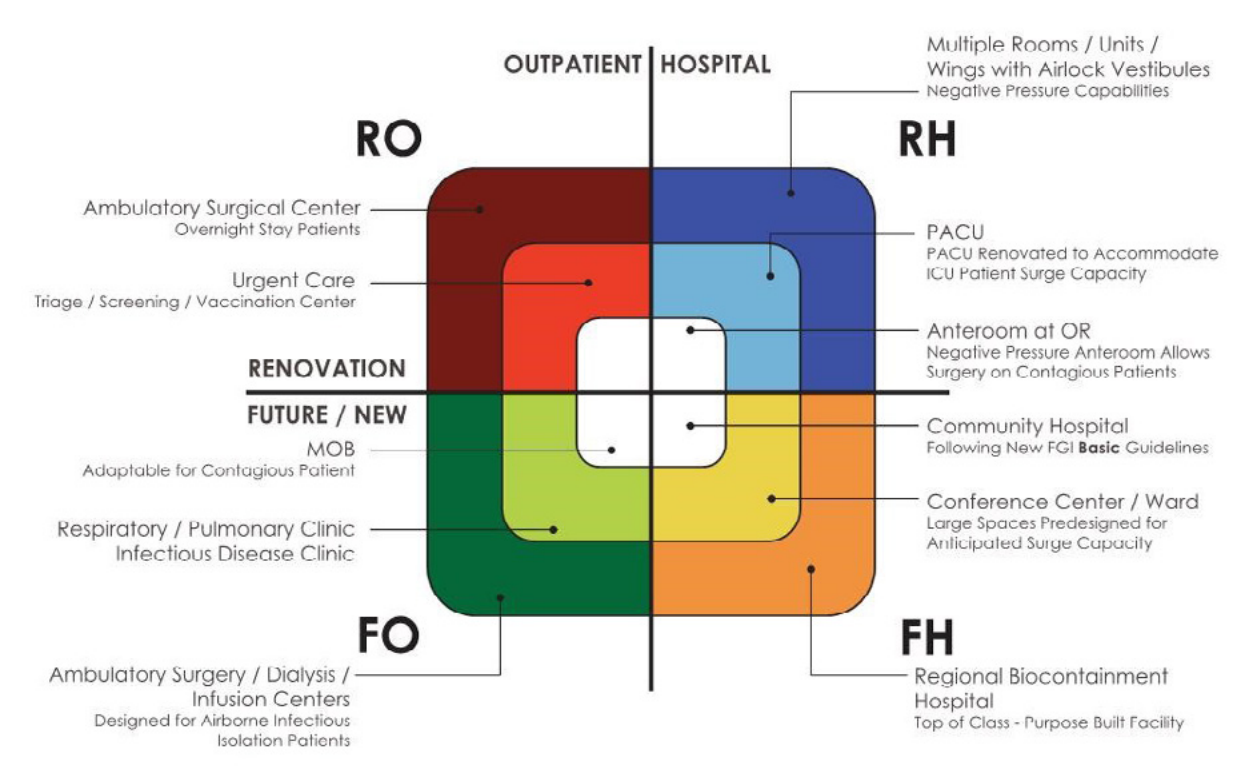
- Life span of the renovations, taking into account the age of the facility and its expected future use if it is part of a system with multiple buildings
- Cost as related to return on investment
- Whether the renovation could improve the health care organization's ability to accommodate a surge in census
- Whether a "step-up" strategy (advanced adapted use) could be applied to the renovated space

Recommendations for New Construction Projects

When planning future projects, individual facility risk assessments and functional programs should be reviewed to determine desired layers of emergency response, both hardening and surge viability. Specific design criteria and functional program narratives can be crafted to help design professionals achieve the health care organization's goals. Goals for design of future facility projects should include the following:

- Achieve the highest level of compliance with recommended elements to support emergency response through a thorough rather than a selective application of design principles.
- Achieve all the basic recommendations.
- Anticipate potential surge capacity needs and design to accommodate them.

Figure 5-2: Expected Response Levels for Some Facility Types



Recommendations for Some Outpatient Ambulatory Care Centers

In planning for a health care organization's emergency response, special focus is needed on certain outpatient facilities where treatments provided require ongoing, scheduled continuity (e.g., infusion centers and dialysis facilities). Maintaining patient access for chronic disease management destinations is vital. Urgent care centers, freestanding emergency facilities, and birth centers also need to remain available for patient access.

Locations such as these will have both "infected" and "screened negative" patient populations. Separation of flows will be critical, and creative scheduling with days on and days off will allow for cleaning. See the proposed changes to the 2018 FGI Outpatient *Guidelines* text for recommendations for these facilities.

Building in Resilience

The FGI Emergency Conditions Committee endeavored to articulate recommendations for facility responses to emergency conditions that would be included in future *Guidelines* editions. The nature of emergency conditions has, at its core, implications driving more of the population to seek care than is commonly anticipated during health care facility planning and design. Surge conditions (quick or slow, short or long-lasting) stress facilities beyond their capacity. The recommendations made in this chapter are intended to help health care organizations plan for a surge in a way that will support safety for patients and caregivers and encourage the foresight needed to create accommodations that are durable and ready to deploy when needed.

Benefits of an Emergency Preparedness Outlook

Incorporating the resilient design elements discussed in this chapter in new construction and renovation of health care facilities has these benefits:

- Enhanced patient safety
- Enhanced worker and workplace safety
- Shortened timeframe to react to "big bang" events
- Elasticity in surge/mass casualty or admission waves driven by an emergency condition
- Embedded flexibility, which is key to facing the unknowns of future emergency conditions, whatever they may be

For renovation projects, the cost to existing facilities and impact on patient access are kept to those items deemed most effective and can be well-planned and thoughtfully constructed to current FGI standards and the requirements of other applicable codes and standards. Many of the recommendations for future facility projects have potentially no or minimal added costs or square footage ramifications; rather, an application of funds and space goes toward solutions that can inherently accommodate emergency conditions.

Many of the recommendations included here would require significant expense, whether as renovation projects or design criteria for future facilities. Because of the common view that an emergency condition is "not a constant state," the potential

payback from capital expenses for modifications that could moderate future surge impacts or increase facility resilience may not be recognized. However, when health care organizations plan for physical environment solutions to mitigate risk from hazards from the outset of their new construction and renovation projects, the result is health care facilities that are better prepared to support an organization's response to the many types of emergency conditions discussed in this paper.

Endnotes

1 J. J. Herstein; A. B. Le; L. A. McNulty, et al., "Update on Ebola Treatment Center Costs and Sustainability, United States, 2019," *Emerging Infectious Diseases 26*, no. 5 (2020):1007-09. https://dx.doi.org/10.3201/eid2605.191245.

2 American College of Emergency Physicians, "COVID-19 Emergency Department Response Strategies" (March 2020). https://www.acep.org/globalassets/new-pdfs/covid-19-for-emergency-department-response-strategies.pdf

3 L. J. J. Quah; B. K. K. Tan; T. P. Fua, et al., "Reorganising the emergency department to manage the COVID-19 outbreak, *International Journal of Emergency Medicine* 13, no. 32 (2020). https://doi.org/10.1186/s12245-020-00294-w

4 ASHRAE, "ASHRAE Position Document on Infectious Aerosols," PDF file, April 14, 2020, https://www.ashrae.org/File%20Library/About/Position%20Documents/PD_InfectiousAerosols_2020.pdf.

5 "Clinical Experiences Keeping Infusion Pumps Outside the Room for COVID-19 Patients," Institute for Safe Medication Practices (April 3, 2020). https://ismp.org/resources/clinical-experiences-keeping-infusion-pumps-outside-room-covid-19-patients

6 See Chapter 1 in this white paper for information on risk assessments. A sample hazard vulnerability assessment from Kaiser Permanente can be downloaded from this page on the California Hospital Association's Emergency Preparedness website: https://www.calhospitalprepare.org/hazard-vulnerability-analysis.

Proposed Language Based on the 2018 Hospital *Guidelines*

The proposed new language below shows changes to the 2018 FGI *Guidelines* recommended by the renovation and future facility design subcommittee of the Emergency Conditions Committee. Additions are underlined, and deletions indicated with a ~~strikethrough~~. Where an appendix item (i.e., a non-enforceable recommendation or guidance on applying a requirement) has been provided, an asterisk (*) precedes the section number (e.g., *1.2-4 Safety Risk Assessment). Appendix items can be identified by the letter "A" that precedes the correlating section number (e.g., A1.2-4 SRA). The text shown has been excerpted from the 2018 *Guidelines* and is not comprehensive. These proposed changes have been adapted and incorporated with recommended changes from other subcommittees in the draft *Guidelines for Emergency Conditions in Health and Residential Care Facilities* in the last section of this white paper.

2.1 Common Elements for Hospitals

...

2.1-2 Patient Care Units and Other Patient Care Areas

...

***2.1-2.2 Patient Room**

...

2.1-2.2.9 Building System Components

2.1-2.2.9.1 Patient room requirements

(1) **Electrical receptacles.** See Table 2.1-1 (Electrical Receptacles

for Patient Care Areas in Hospitals).

(2) **Call systems.** See Table 2.1-2 (Locations for Nurse Call Devices in Hospitals).

(3) **Medical gas systems.** See Table 2.1-3 (Station Outlets for Oxygen, Vacuum, Medical Air, and Instrument Air Systems in Hospitals).

2.1-2.2.9.2 Surge requirements. Patient rooms intended to accommodate double occupancy during a surge event shall meet the requirements for critical care patient rooms in the tables listed in Section 2.1-2.2.9.1 (Patient room requirements).

***2.1-2.4.2 Airborne Infection Isolation (AII) Room**

A2.1-2.4.2 For additional information, refer to the Centers for Disease Control and Prevention (CDC) publication "Guidelines for Preventing the Transmission of *Mycobacterium tuberculosis* in Health-Care Settings," December 2005, and "Guidelines for Environmental Infection Control in Health-Care Facilities," December 2003, both published in *MMWR* and available on the CDC website.

2.1-2.4.2.1 General

...

(3) Location.

(a) AII rooms shall be permitted to be located in individual patient care units or grouped as a separate isolation patient care unit.

A2.1-2.4.2.1 (3)(a) AII unit. Consider using life safety compartmentalization to develop a self-contained AII patient care unit.

a. *Entry/exit.* An entry/exit transition space, similar to that for a NICU or bone marrow transplant unit, should be provided for an isolation unit.

b. *Staff transition zone.* Consider providing a defined staff entry/egress point into each isolation unit for donning PPE and hand-washing. Consider locating staff lockers and changing area readily accessible to the staff transition zone.

(b) When determined by an ICRA or the health care organization's disaster, emergency, and vulnerability assessment, a designated patient care unit or portion of a patient care unit shall be designed as an airborne infection isolation unit or sub-unit.

2.1-2.4.2.2 AII room requirements. Each airborne infection isolation room shall comply with the requirements in sections 2.1-2.2 (Patient Room) and 2.2-2.2.2 (Medical/Surgical Patient Care Unit: Patient Room) as well as the following requirements:

(1) Capacity. Each AII room shall contain only one bed.

(2) Provision shall be made for personal protective equipment (PPE) storage at the entrance to the room.

(3) Hand-washing station. Section 2.1-2.2.5.3 (Hand-washing station in the patient room—Renovation) shall not apply to AII rooms.

(4) The patient toilet room shall serve only one AII room.

(5) The patient toilet room shall have a bathtub or shower.

(6) A door from the AII room directly to the corridor shall be permitted.

*(7) Doors to the AII room shall have a view panel that allows staff to see the patient.

A2.1-2.4.2.2 (7) A view panel will allow staff to see the patient without entering the room, which may minimize the number of times staff must enter the AII room. This is particularly important during a pandemic or epidemic.

2.1-2.4.2.3 Anteroom~~.~~

(1) Whether an ~~An~~ anteroom is ~~not~~ required shall be determined by the infection control risk assessment (ICRA). See Section 1.2-4.2.2.1 (2) (ICRA Considerations—Design elements) for requirements. ~~; however, where~~

(2) Where an anteroom is provided, it shall meet the following requirements:

(a) ~~(1)~~ The anteroom shall provide space for persons to don personal protective equipment (PPE) before entering the patient room and doff PPE before leaving.

(b) ~~(2)~~ All doors to the anteroom shall have self-closing devices or an audible alarm arrangement that can be activated when the AII room is in use as an isolation room.

(c) The door from the anteroom to the AII room shall have a view panel that allows staff to see the patient.

(d) ~~(3)~~ The anteroom shall be equipped with at least the following:

(i) ~~(a)~~ Hand-washing station

(ii) ~~(b)~~ Storage for unused PPE

(iii) ~~(c)~~ Disposal/holding container for used PPE

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*2.1-2.8.7 Hand-Washing Station

A2.1-2.8.7 Provision of hand sanitation dispensers. Consideration should be given to providing sanitation dispensers in all meeting rooms or education/training rooms to support infection prevention during a pandemic or epidemic.

2.1-2.8.7.1 Location

(1) Hand-washing stations shall be provided in each room where hands-on patient care is provided.

(2) For location and number requirements, see other common element sections in this chapter and the facility chapters.

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*2.1-2.8.10 Ice-Making Equipment

A2.1-2.8.10 Noise from ice-making equipment. The location of and space for ice-making equipment in a patient care unit should be designed to mitigate noise. This can be achieved through various means, including considering its placement in relation to patient rooms or locating it in an enclosed space. See Table 1.2-6 (Design Criteria for Minimum Sound Isolation Performance Between Enclosed Rooms) for information about sound for patient rooms.

~~**2.1-2.8.10.1** In public areas, a~~ All ice-making equipment shall be of the self-dispensing type.

~~**2.1-2.8.10.2** In areas restricted to staff only, use of storage bin-type equipment for making and dispensing ice shall be permitted.~~

2.1-2.8.11 Clean Workroom or Clean Supply Room

***2.1-2.8.11.1 General.** The clean workroom or clean supply room

shall be separate from and have no direct connection with the soiled workroom or soiled holding room.

A2.1-2.8.11.1 If more than one clean workroom or clean supply room is provided on a single patient care unit, consider locating one of them to allow for restocking/resupply without entering the unit. A room with a door that opens into the unit and another door that opens into the corridor outside the unit would serve this purpose.

***2.1-2.8.12 Soiled Workroom or Soiled Holding Room**

A2.1-2.8.12 Functions for soiled workroom and soiled holding room

a. *Soiled workroom*. Soiled items may be handled in a soiled workroom to prepare them for subsequent cleaning, disposal, or reuse (e.g., emptying and rinsing bedpans or emesis basins, emptying or solidifying suction canisters, rinsing and gross cleaning of medical instruments). As well, this room provides temporary storage for soiled items prior to their removal from the unit.

b. *Soiled holding room*. This location is used exclusively for temporary storage of soiled materials and/or supplies prior to their removal from the unit.

***2.1-2.8.12.1 General.** Soiled workrooms and soiled holding rooms shall be separate from and have no direct connection with either clean workrooms or clean supply rooms.

A2.1-2.8.12.1 Soiled workrooms/holding rooms. If more than one soiled workroom or soiled holding room is provided on a patient care unit, consider locating one of them to allow for removal of materials and equipment without having to enter the unit.

2.1-2.8.13.1 Clean linen storage. This storage shall meet the following requirements:

(1) Clean linen shall be permitted to be stored in the clean workroom, in a separate closet, or using a covered cart distribution system on each floor.

*(2) Where a covered cart distribution system is used, storage of clean linen carts in a corridor alcove shall be permitted.

A2.1-2.8.13.1 (2) In an AII patient care unit, clean supplies of any type—including linen—should not be kept in alcoves exposed to general unit circulation, regardless of cart type.

2.1-2.8.14 Environmental Services Room

2.1-2.8.14.1 General

*(1) Application. One environmental services room shall be permitted to serve more than one patient care unit on a floor.

2.1-2.8.14.1 (1) Limiting an environmental services room to serving one patient care unit will provide greater ability to isolate the patient care unit if required during a pandemic or other emergency condition.

*(2) Location. An environmental services room shall be readily accessible to the unit or floor it serves.

A2.1-2.8.14.1 (2) Environmental services room. Some departments or areas may need individually assigned environmental services rooms. Examples include:

—Patient care units

—Clinical areas: Pre- and post-procedure patient care areas, examination rooms, blood draw areas, dialysis treatment areas, infusion areas, and other areas likely to come into contact with blood or body fluids

—Sterile areas: Operating rooms, corridors in the semi-restricted area of the surgery suite, sterile labs, and sterile storage

—Endoscopy services rooms: Endoscopy procedure room and endoscope processing room

—Public and administrative areas: Waiting areas, offices, and hallways

—Compounding pharmacy

—Any functional areas identified as surge spaces by an infection control risk assessment

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***2.1-2.9 Support Areas for Staff**

A2.1-2.9 Support areas for staff

a. *Location.* Support areas for staff should be restricted from public access as defined in section 02: Buildings and the Internal Environment in the IAHSS *Security Design Guidelines for Healthcare Facilities.* Wherever possible, staff lounge facilities should have access to daylight and views of the outdoors.

b. *Staff shower room.* Staff showers should be provided, either on the patient care unit or shared between units or services. These accommodate staff who may have to stay at the hospital for several days during an emergency situation or who desire to wash up prior to exiting the facility to moderate potential infectious exposure of the general public. It is preferable to include these spaces in

the initial project design rather than trying to add them later.

c. ~~b.~~ *Staff rest areas.* Staff rest areas should be provided for every unit that has overnight patient care activities....

***2.1-2.9.1 Staff Lounge Facilities**

Lounge facilities of no less than 100 square feet (9.29 square meters) shall be provided.

A2.1-2.9.1 Designation of separate active and quiet lounge/respite areas is recommended.

2.1-2.9.2 Staff Toilet Room...

2.1-2.9.3 Staff Storage Facilities...

2.1-3.2 Examination Room or Emergency Department Treatment Room

2.1-3.2.1 General

...

2.1-3.2.1.3 Building system components. See the following tables for exam room requirements:

(1) Table 2.1-1 (Electrical Receptacles for Patient Care Areas in Hospitals)

(2) Table 2.1-2 (Locations for Nurse Call Devices in Hospitals)

(3) Table 2.1-3 (Station Outlets for Oxygen, Vacuum, Medical Air, and Instrument Air Systems in Hospitals)

2.1-3.2.1.4 Features to support isolation of patients. At least one exam room per medical specialty shall be entered through an

anteroom and shall have HVAC design equal to that for an airborne infection isolation (AII) room.

2.1-3.2.1.5 Telemedicine. All exam rooms shall be telemedicine-capable. See Section 2.1-3.3 (Accommodations for Telemedicine Services) for requirements.

2.1-3.2.4 Sexual Assault Forensic Examination Room

Where a sexual assault forensic examination room is provided, it shall meet the requirements in Section 2.1-3.2.2 (Single-Patient Examination Room) and the following:

...

2.1-3.2.4.3 The room shall have a ventilation system capable of providing negative pressure.

***2.1-3.2.5 Acuity-Adaptable Examination Room**

Where an acuity-adaptable examination room is provided, it shall meet the requirements in Section 2.1-3.2.2 (Single-Patient Examination Room) as amended in this section:

> **A2.1-3.2.5 Acuity-adaptable exam room.** These rooms are intended to accommodate high-acuity patients or to house two beds or three recliners when needed for surge capacity.

2.1-3.2.5.1 General. The number of acuity-adaptable exam rooms of each type to be provided in a facility shall be determined by an infection control risk assessment (ICRA):

(1) Rooms sized to house two patients

(2) Rooms capable of negative pressure

(3) Rooms capable of positive pressure

2.1-3.2.5.2 Clearances. Room size shall permit a room arrangement with the following minimum clearances when the room is used as a single-patient exam room:

(1) 3 feet 6 inches (xx centimeters) on the provider side

(2) 5 feet (xx centimeters) on the transfer side

(3) 4 feet (xx centimeters) at the foot of the examination table

(4) 18 inches (xx centimeters) at the head of the bed

***2.1-3.3 Accommodations for Telemedicine Services**

A2.1-3.3 Patient experience. Remote communications via electronic equipment, although not a replacement for in-person care, may be offered as a supplement where in-person care is not available or medically necessary. To assist in the adoption of telemedicine and maximize its benefits for elderly patients, those unaccustomed to electronic communication, and those with vision, hearing, or cognitive impairments, care should be given to remove technological barriers and provide telemedicine endpoints that facilitate natural communication for the widest range of participants. Facilities and systems used for telemedicine communications should strive to maintain the level of safety, privacy, quality of care, and patient experience that would be expected for in-person communication.

***2.1-3.3.1 General**

Where clinical telemedicine services are provided in a health care facility, telemedicine spaces to accommodate those services shall meet the requirements in this section.

A 2.1-3.3.1 Telemedicine service types

a. Services may include one-on-one interactions, consultations with a patient and family members (e.g., pediatric or elderly patients), examinations supported by a telemedicine presenter located with the patient, or specialty services such as dermatology or orthopedics. Each type of service may have specific needs for lighting and space to support the clinical function; for example, evaluation of patient gait requires unobstructed space to walk from one end of the bay, cubicle, or room to the other. Therefore, to achieve a functional design, it is important to know what services will be provided.

b. The requirements in this section are not intended to apply to virtual visits that do not require a physical examination of the patient or visits that originate from a physician's or patient's home.

***2.1-3.3.2 Telemedicine Bay, Cubicle, or Room**

A bay, cubicle, or room shall be provided for telemedicine services.

A2.1-3.3.2 Design considerations for telemedicine.
The telemedicine health care provider environment can be located in any space that is HIPAA-compliant. Recommendations for the patient environment are included here:

a. Equipment

—Camera placement should be set so recipients perceive the exchange as happening eye-to-eye. The discrepancy between gaze angle should be minimal.

—Temperature control should be considered based on the amount of electronic equipment that may generate significant amounts of heat.

—Depending on the complexity of equipment used, multiple outlets may be required for equipment. Outlets should be located near the unit to avoid wires/cables on the floor.

b. Architectural details

—Doors in view of the main camera should be able to be closed to assure maximum privacy during the telemedicine appointment.

—Placement of doors behind the patient should be avoided as this can make patients uncomfortable.

2.1-3.3.2.1 General

(1) A bay, cubicle, or room where clinical telemedicine services are provided shall meet the requirements of the section of the *Guidelines* that directly relates to the services provided and the patient population served.

(2) Where patient volume does not justify provision of a dedicated telemedicine room, the telemedicine room shall be permitted to serve other functions such as physician's office, exam room, or conference room.

(3) Locations where clinical telemedicine services are provided shall include capability for remote monitoring of vitals and pumps, etc., from staff stations.

2.1-3.4 Pre- and Post-Procedure Patient Care

2.1-3.4.1 General

...

2.1-3.4.2 Patient Care Station Design

2.1-3.4.2.1 General

(1) Bays, cubicles, or single-patient rooms that meet the requirements in this section shall be permitted to serve as patient care stations.

(2) Pre- and post-procedure patient care stations shall be organized in pods that can be independently accessed and managed, including from the building systems standpoint.

(3) Space shall be provided at the perimeter of the pre- and post-procedure patient care area that can be flexibly converted into space for donning and doffing of personal protective equipment.

2.1-3.4.2.2 Space requirements

(1) Area. When determining the area for a patient care station, space needed for equipment shall be identified.

*(2) Clearances

A2.1-3.4.2.2 (2) Clearances in patient care stations

a. Two bays may be used to accommodate non-standard equipment (e.g., an expanded-capacity patient bed), but clearances do not include any area that would have to be shared to meet the standard. Clearances noted around gurneys are between the normal use position of the gurney and any adjacent fixed surface or between adjacent gurneys.

b. Sizing all pre- and post-procedure patient care stations with the largest clearances is recommended to provide flexibility of use during an emergency or for future uses.

(a) Where bays are used, the following minimum clearances shall be provided:

(i) 5 feet (1.52 meters) between the sides of patient beds/gurneys/lounge chairs

(ii) 3 feet (91.44 centimeters) between the sides of patient beds/gurneys/lounge chairs and adjacent walls or partitions

(iii) 2 feet (60.96 centimeters) between the foot of patient beds/gurneys/lounge chairs and the cubicle curtain

(b) Where cubicles are used, the following minimum clearances shall be provided:

(i) 3 feet (91.33 centimeters) between the sides of patient beds/gurneys/lounge chairs and adjacent walls or partitions

(ii) 2 feet (60.96 centimeters) between the foot of patient beds/gurneys/lounge chairs and the cubicle curtain

(iii) Where bays or cubicles face each other, an aisle with a minimum clearance of 8 feet (2.44 meters) independent of the foot clearance between patient stations or other fixed objects shall be provided.

(c) Where single-patient rooms are used, 3 feet (91.44 centimeters) shall be provided between the sides and foot of beds/gurneys/lounge chairs and adjacent walls or partitions.

2.1-3.4.2.3 Provisions shall be made for the isolation of infectious patients.

(1) An airborne infection isolation (AII) room is not required in pre- and post-procedure patient care areas.

(2) Provisions for the recovery of a potentially infectious patient with an airborne infection shall be determined by an infection control risk assessment (ICRA). The ICRA shall determine requirements for the following:

(a) Percentage of pre- and post-procedure patient care areas to be capable of negative pressure

(b) Percentage of pre- and post-procedure patient care areas to be AII room-ready and include an anteroom

2.1-3.4.2.4 Patient privacy. Provisions shall be made for patient privacy in accordance with Section 2.1-2.1.2 (Patient Privacy).

2.1-3.4.2.5 Hand-washing stations. See Section 2.1-2.8.7 (Hand-Washing Station) for requirements.

***2.1-3.4.2.6 Other design requirements**

A2.1-3.4.2.6 Equipment monitoring. Patient care station design should support the use of equipment capable of remote monitoring of patient vitals, including blood oxygen saturation (SPO), and of pumps and other medical equipment. When the patient care station is a single-patient room, at minimum the equipment should be visible from outside the patient care station through a window or view panel.

(1) For electrical receptacle requirements, see Table 2.1-1 (Electrical Receptacles for Patient Care Areas in Hospitals).

(2) For nurse call requirements, see Table 2.1-2 (Locations for Nurse Call Devices in Hospitals).

(3) For oxygen and vacuum requirements, see Table 2.1-3 (Station Outlets for Oxygen, Vacuum, Medical Air, and Instrument Air Systems in Hospitals).

2.1-4.1 Laboratory Services

...

2.1-4.1.3 Specimen Collection Facilities

2.1-4.1.3.1 General

(1) Space shall be provided for specimen collection.

*(2) Specimen collection facilities shall be permitted to be outside the laboratory work area.

> **A2.1-4.1.3.1 (2) Alternate specimen collection sites.** Planning for emergency conditions should include consideration of what is needed in the physical environment to support specimen collection sites located in the lobby and outside the facility, possibly in tents or parking structures.

2.1-4.1.3.2 Facility requirements. At minimum, specimen collection facilities shall have the following:

(1) A blood collection area with:

(a) Work counter

(b) Space for patient seating

(c) Hand-washing station(s)

(d) Supply storage

(2) A urine and feces collection facility equipped with a toilet and a hand-washing station

(3) Storage space for specimen collection supplies

(4) Work counter for labeling and computerized data entry

(5) Storage for specimens awaiting pickup

2.1-4.2.8 Support Areas for the Pharmacy

...

*__2.1-4.2.8.2 Office.__ A separate room or area shall be provided for office functions.

__A2.1-4.2.8.2 Office.__

a. When sizing this room, consider the space needed to accommodate a desk, filing capabilities, communication equipment, and reference materials.

b. Consider providing necessary data outlets and sound attenuation to support increased consultation regarding medications during an emergency condition.

__2.1-4.2.8.3 A room for education and training.__ A multipurpose room shared with other departments shall be permitted to serve this purpose.

*__2.1-4.2.8.4 Outpatient medication consultation area.__ If medication is dispensed to outpatients from the hospital pharmacy, an area for consultation and patient education shall be provided.

__A2.1-4.2.8.4 Considerations for medication consultation during emergency conditions.__ Consider providing necessary data outlets and sound attenuation to support increased consultation regarding medications that may become necessary during an emergency condition. Because consultation often requires face-to-face communication, configurations to support safe interaction with an infectious patient should be considered.

__2.1-4.2.8.5 – 2.1-4.2.8.6 Reserved__

*__2.1-4.2.8.7 Hand-washing station.__ A hand-washing station(s) shall be provided either in an anteroom or immediately outside the room where open medication(s) are prepared.

...

2.1-4.2.8.13 Additional equipment and supply storage. If a unit dose procedure is used, additional space and equipment shall be provided to accommodate supplies, packaging, labeling, and storage, including space for carts.

2.1-4.3 Food and Nutrition Services

2.1-4.3.1 General

***2.1-4.3.1.1 Application.** Facilities and equipment shall be provided to support food services provided for staff, visitors, and patients.

A2.1-4.3.1.1 Food services

a. *Common food services.* Food service in a hospital may be provided in special dining areas (e.g., a physicians' dining room, conference center, boardroom, training facilities) and in retail serving areas for staff, ambulatory patients, and visitors. In addition, snacks between scheduled meals may be provided.

b. *Food service considerations for emergency conditions.* As dining is a key component of ongoing operations regardless of emergency conditions, the food service supply chain and storage capacity and corresponding ability to support meals for caregivers, patients, and the public during an emergency condition should be reviewed as part of the disaster, emergency, and vulnerability assessment. Physical environment supports needed for provision of continuous food service during an emergency should be determined.

2.1-6 Public and Administrative Areas

*2.1-6.1 General

A2.1-6.1 Public and administrative areas are those non-patient care areas where the public is received into the hospital and where administrative functions in support of hospital operations take place.

These areas should be designed with consideration for security principles involving zones of protection as defined in Section 02: Buildings and the Internal Environment in the IAHSS *Security Design Guidelines for Healthcare Facilities*. As well, during project planning and design, means for supporting a one-way path of travel for those entering the facility during a pandemic or mass casualty event should be identified.

2.1-6.1.1 Application

Where required by the facility chapters, public and administrative areas shall be designed according to the requirements in Section 2.1-6 (Public and Administrative Areas).

2.1-6.1.2 Location

Public areas shall be clearly identified and located to accommodate persons with disabilities.

2.1-6.2 Public Areas

The following shall be provided:

*2.1-6.2.1 Vehicular Drop-Off and Pedestrian Entrance

2.1-6.2.1.1 A minimum of one drop-off or entrance shall be reachable from grade level.

A2.1-6.2.1 Climate, patient acuity, and community standards may influence whether a covered or canopied entrance is desired.

2.1-6.2.1.2 Power, data, and water connections shall be provided at the drop-off and pedestrian entrance to facilitate flexible conversion to external triage stations in an emergency situation.

2.1-6.2.2 Reception Area or Lobby

2.1-6.2.2.1 This space shall include the following:

(1) Access to information

(2) Public waiting area(s)

(3) Public toilet room(s)

(4) Provisions for telephone access

(5) Provisions for drinking water

2.1-6.2.2.2 The following accommodations for emergency response shall be located in or readily accessible to the reception area or lobby:

(1) Sanitizing stations

(2) Power/data points for deployment of temporary scanners and other equipment necessary for triage at entry

(3) Signage or other cues for safe distancing when queuing.

(4) Means to provide an alternate point of access for potentially contagious patients (fever entry concept)

(5) Storage for screening equipment (on-site for easy deployment)

2.1-6.2.2.3 ~~2.1-6.2.2.2~~ Shared lobbies shall be permitted in multi-occupancy buildings.

2.1-6.3 Administrative Areas

...

2.1-6.3.4 Multipurpose Room

2.1-6.3.4.1 Several services or departments shall be permitted to share one multipurpose room.

2.1-6.3.4.2 Shared use of an office or interview room for this purpose shall be permitted.

2.1-6.3.4.3 Multipurpose rooms shall be designed for flexible conversion to a staff respite space, space for donning and doffing personal protective equipment, a control center, or other use during an emergency as determined by an infection control risk assessment.

2.1-6.4 Support Areas for Staff and Volunteers

2.1-6.4.1 Lockers, lounges, showers, and toilets shall be provided for employees and volunteers.

2.1-6.4.2 Lockers, lounges, showers, and toilets for staff shall be separate from those provided for the public.

2.1-7.2.2.3 Doors and door hardware. Door and door hardware finishes shall be selected to withstand impact damage and cleaning with EPA-registered hospital disinfectants.

*(1) Door type

> **A2.1-7.2.2.3 (1) Hands-free doors.** Doors should permit patients, caregivers, and visitors to open them without the use of hands.

(a) All doors between corridors, rooms, or spaces subject to occupancy shall be of the swing type or shall be sliding doors.

*(b) Sliding doors

A2.1-7.2.2.3 (1)(b) Sliding doors. Use of sliding doors rather than swing doors is highly recommended for airborne infection isolation rooms, protective environment rooms, and other spaces for which an ICRA has identified infection control as an issue. Research has shown that swinging door motion induces up to six times more possible contaminates than sliding door motion and can significantly affect contaminant control.

(i) Use of manual or automatic sliding doors shall be permitted where fire and other emergency exiting requirements are not compromised.

(ii) Sliding doors with emergency breakaway features in the full open position shall be permitted to temporarily restrict the minimum corridor width required by applicable building codes.

*(iii) Sliding doors shall not have floor tracks.

A2.1-7.2.2.3 (1)(b)(iii) Eliminating floor tracks and using breakaway door hardware minimizes the possibility of jamming.

...

(3) Door swing

*(a) Doors shall not be permitted to swing into corridors except doors in behavioral health units and doors to non-occupiable spaces (e.g., environmental services rooms, electrical closets) and doors with emergency breakaway hardware.

A2.1-7.2.2.3 (3)(a) The intent of this requirement is to avoid injury caused by outward swinging doors.

(b) Doors shall be permitted to swing outward into an alcove that is deeper than the width of the door.

(c) A 180-degree door swing is not exempt from this requirement.

*(4) Door hardware~~. Lever hardware or push/pull latch hardware shall be provided.~~

(a) Push/pull hardware shall be utilized in all rooms where patients are treated.

(b) Use of lever hardware shall be permitted in staff areas where staff can control cleaning of the hardware.

(c) Lever hardware shall be permitted on toilet room doors.

A2.1-7.2.2.3 (4) Door protection should be provided where a door is subject to impact.

(5) Doors for patient bathing/toilet facilities...

***2.1-7.2.2.8 Hand-washing stations**

...

(5) Provisions for drying hands. Provisions for hand drying shall be required at all hand-washing stations (except hand scrub facilities).

(a) Hand-washing stations shall include a hand-drying device that does not require hands to contact the dispenser.

(b) These provisions shall be enclosed to protect against dust or soil and to ensure single-unit dispensing.

~~(c) Hot air dryers shall be permitted.~~

(c) ~~(d)~~ Where provided, single-use towels shall be directly accessible to sinks.

***2.1-7.2.3 Surfaces**

A2.1-7.2.3 Characteristics and criteria for selecting surface and furnishing materials and products. The effect of surface materials, colors, textures, and patterns on patient, staff, and visitor safety and on maintenance and life cycle performance should be considered in the overall planning and design of the facility.

...

c. Patient safety risk assessment issues addressed by surfaces and furnishings performance characteristics and criteria

—*Reduction of surface contamination linked to health care-associated infections (HAIs).* Surfaces and furnishings selected should have clear, written manufacturer-provided cleaning protocols that will ensure the product remains durable and can meet CDC cleaning standards for health care facilities.

- Surfaces should be easy to clean, with no surface crevices, rough textures, joints, or seams.
- Surfaces should be non-absorptive, nonporous, and smooth.
- Manufacturer-recommended cleaning and disinfection methodologies should be easy to use and effective for meeting CDC and other clinical bacterial elimination requirements.

- Verify that cleaning techniques in the manufacturer's use instructions for all surfaces are consistent with the cleaning products and techniques specified in the ICRA.

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*__2.1-7.2.4.3 Privacy curtains in patient rooms and other patient care areas.__ Use of fabric privacy curtains shall be permitted if the fabric is washable.

A2.1-7.2.4.3 Use of disposable curtains or a wipeable fabric with a smooth surface is preferable.

2.1-8 Building Systems

2.1-8.1 General

2.1-8.1.1 Behavioral and Mental Health Patient Locations

In behavioral and mental health patient rooms, toilet rooms, and seclusion rooms, ceiling and air distribution devices, lighting fixtures, sprinkler heads, and other appurtenances shall be of a tamper- and ligature-resistant type.

2.1-8.1.2 Building System Considerations for Emergency Conditions

The requirements in this section shall be met in locations indicated in the disaster, emergency, and vulnerability assessment (DEVA).

2.1-8.1.2.1 General

(1) Standard patient bed headwalls shall be designed to meet power and medical gas requirements for more than one patient care station.

(2) Provisions for power, data, and water for use when staging for pandemic or mass casualty events shall be located on outside walls in places identified for use as potential outdoor screening locations or for other potential uses in an emergency.

2.1-8.1.2.2 HVAC systems

(1) Air-handling unit coils shall be oversized so they can operate at 100 percent outdoor air in locations indicated in the DEVA.

(2) Patient rooms

(a) Design flexibility shall be provided to allow the addition of a louver above the ceiling or at the window to convert the patient room to a negative pressure room.

(b) Ventilation in standard patient rooms shall be designed so air changes per hour (ACH) can be increased from 4 ACH on demand as indicated in the DEVA.

(c) Where exhaust registers are provided, they shall be located above patient beds to support unidirectional airflow.

(3) Negative pressure exam rooms. HVAC design shall permit switching a neutral pressure exam room to a negative pressure room.

A2.1-8.1.2.2 (3)(a) Negative pressure exam room. Control of the switch from neutral to negative pressure can be accomplished using a local pressure monitor key switch, the building automation system, or a keypad device.

*(a) The switch from neutral to negative pressure shall not require the addition of specific provisions for an airborne infection isolation room (e.g., attached toilet room, 12 air changes per hour, a monitoring device, maintenance of 0.01" negative static pressure).

(b) Provision of HEPA filtration and/or 100% outside air shall be considered in conjunction with the negative pressure control settings.

(4) HVAC design shall provide the ability to convert final filters to HEPA filters.

(5) HVAC design shall make it possible to change from return air to exhaust air for designated areas during a pandemic. A separate exhaust system, including exhaust fan with motorized dampers, shall be provided to close the return air path when a specific location is being exhausted.

2.1-8.3.4.3 Lighting for specific locations in the hospital

*(1) Patient rooms. Patient rooms shall have general lighting and night-lighting.

A2.1-8.3.4.3 (1) Hands-free lighting controls. Hands-free functionality is preferable for lighting controls when this feature is available for light fixtures chosen. The goal is to avoid high-touch locations that might become transmission vectors for spreading infection.

(a) Lighting for reading shall be provided for each patient bed.

(i) Reading light controls shall be accessible to the patient(s) without the patient having to get out of bed.

(ii) Incandescent and halogen light sources that produce heat shall be placed or shielded to protect the patient from injury.

(iii) Unless the light source is specifically designed to protect the space below, the light source shall be covered by a diffuser or lens.

(iv) Flexible light arms, if used, shall be mechanically controlled to prevent the lamp from contacting the bed linen.

*(b) At least one night-light fixture shall be located in each patient room. This requirement does not apply to critical care patient rooms where view panels are provided to the corridor.

A2.1-8.3.4.3 (1)(b) Night-lighting

a. Night-lights with lamps that have a warm-up time or a delay in reaching the intended light level should be avoided.

b. The night-light should be mounted on the wall near the floor to avoid disturbing the patient.

*(i) Central control of night-lights such as a common switch at the nurse station or time clock shall be prohibited.

A2.1-8.3.4.3 (1)(b)(i) The night-light should be controlled at the room entrance. Night-long use of night-lights is typically patient dependent. Some patients prefer dark rooms and are disturbed by night-lights. Patient control of the night-light may also be provided via three-way switching or low-voltage controls.

*(ii) The night-light shall be located for staff and patient use to illuminate both the path from the room entrance to the bedside and the path between the bed and the toilet room.

A2.1-8.3.4.3 (1)(b)(ii) Indirect lighting should be provided to reduce glare on surfaces to accommodate vision issues for patient comfort.

(c) Lighting for critical care bed areas shall permit staff observation of the patient while minimizing glare.

2.1-8.7.2 Elevators

*__2.1-8.7.2.1 General.__ Hospitals with patient facilities (e.g., patient rooms, dining rooms, recreation areas) or critical services (e.g., operating, delivery, diagnostic, therapeutic areas) located on floors other than the grade-level entrance floor shall have elevators.

> **A2.1-8.7.2.1** Consideration should be given to dedicating and separating elevator types by function, such as those for the public, patients, staff, and materials (e.g., clean vs. soiled flows), as the diverse uses affect both operational efficiency and cross-contamination and infection control issues. Pandemic scenarios should be included in operational design.

2.1-8.7.2.2 Number

(1) At least two hospital-type elevators shall be installed where 1 to 59 patient beds are located on any floor other than the main entrance floor.

(2) At least two hospital-type elevators shall be installed where 60 to 200 patient beds are located on floors other than the main entrance floor, or where the major inpatient services are located on a floor other than those containing patient beds. (Reduction in elevator service shall be permitted for those floors providing only partial inpatient services.)

(3) At least three hospital-type elevators shall be installed where 201 to 350 patient beds are located on floors other than the main entrance floor, or where the major inpatient services are located on a floor other than those containing patient beds. (Reduction in elevator service shall be permitted for those floors providing only partial inpatient services.)

*(4) For hospitals with more than 350 beds, the number of elevators shall be determined from a study of the hospital plan and the expected vertical transportation requirements.

A2.1-8.7.2.2 (4) Methods for conducting a traffic study are described in George R. Strakosch and Robert S. Caporale, *Vertical Transportation Handbook*. Pandemic scenarios should be included in all vertical transportation studies, as identified by an infection control risk assessment.

Chapter 2.2, Specific Requirements for General Hospitals

***2.2-2.2 Medical/Surgical Patient Care Unit**

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2.2-2.2.2 Patient Room

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2.2-2.2.2.2 Space requirements

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*(2) Clearances

(a) The dimensions and arrangement of rooms shall provide a minimum clearance of 3 feet (91.44 centimeters) between the sides and foot of the bed and any wall or other fixed obstruction.

(b) In multiple-patient rooms, a minimum clearance of 4 feet (1.22 meters) shall be available at the foot of each bed to permit the passage of equipment and beds.

A2.2-2.2.2.2 (2) Clearances for surge capacity. When designing patient rooms that can be used to support an organization's ability to increase intensive care unit capacity in an acute patient care unit, consider providing space to accommodate clearances for two beds, including a 66-inch clearance on the transfer side of each bed.

2.2-3.1.3 Emergency Department

2.2-3.1.3.1 General

(1) Application. Hospitals that offer more than basic emergency care services shall have facilities that meet the requirements in this section for the services they provide.

*(2) Security.

(a) Perimeter security. The emergency department shall be designed to ensure that access control can be maintained at all times.

A2.2-3.1.3.1 (2) Perimeter security. ~~**A2.2-3.1.3.3**~~ The exterior perimeter of the emergency department should have the capability to be secured to control access and provide safety in the event of a disaster or situations requiring a higher level of security.

(b) Means to detect weapons, such as a metal detector, shall be provided at each point of entry to the emergency department.

(c) A video surveillance system shall be provided for each emergency department entrance.

(d) Where entrances may be locked, a highly visible duress alarm system shall be provided.

*(3) Path of travel for infectious patients

A2.2-3.1.3.1 (3) Assume that both non-infectious and infectious patients will have to be treated simultaneously (percentage breakdown will vary by facility).

(a) Design for a split-flow at point of entry for different patient populations (fever/influenza, enteric, non-infectious patient, etc.) shall be provided.

(b) A clear route shall be provided for infectious patients arriving by ambulance either through the exterior decontamination facility or straight to the trauma/resuscitation room.

(c) The entire path of travel for infectious patients shall be a negative pressure environment that is 100 percent exhausted.

...

***2.2-3.1.3.3 Reception and triage areas.**

A2.2-3.1.3.3 Emergency preparedness

a. The exterior perimeter of the emergency department should have the capability to be secured to control access and provide safety in the event of a disaster or situations requiring a higher level of security.

b. Whenever possible, triage (for primary care issues) should be diverted to community clinics when the hospital is responding to an emergency.

(1) Location

(a) Reception and ~~or~~ triage areas shall be located to provide a means for observation of the main entrance to the department and the public waiting area.

(b) ~~(2)~~ Public access points to the treatment area shall be under direct observation of the reception and triage areas.

*(2) ~~(3)~~ Triage area. The triage area shall include the following:

A2.2-3.1.3.3 (3) Consider providing a separate area for patients waiting for triage. This area should have appropriate ventilation and be clearly visible from the triage station.

...

(3) ~~(4)~~ As the location of initial assessment for patients with undiagnosed and untreated airborne infections, the triage area shall be designed and ventilated to reduce the exposure of staff, patients, and families to airborne infectious diseases. ~~For requirements, s~~ See ANSI/ASHRAE/ASHE 170: *Ventilation of Health Care Facilities* for requirements.

***2.2-3.1.3.4 Public waiting area**

A2.2-3.1.3.4 During project planning, consider means of separating emergency department waiting areas for those who are injured from those who are ill to reduce potential disease transmission.

(1) A public waiting area with the following shall be provided:

(a) Seating ~~Toilet facilities~~

*(b) Immediately accessible public toilet room(s) with hand-washing station(s)

A2.2-3.1.3.4 (1)(b) Public toilet room. Ligature-resistant design criteria should be considered. See Section 1.2-4.6 (Behavioral & Mental Health Risk Assessment) for more information.

(~~b~~c) ~~Provisions for~~ Access to drinking water

*(~~c~~d) ~~Provisions for~~ Access to public communications services ~~telephone access~~

A2.2-3.1.3.4 (1)(d) Public communications services. Public communication services may include provisions such as telephone access, wireless internet connectivity, and distributed antenna systems to support cell phone use.

(2) Where dedicated pediatric treatment rooms are provided, a separate family waiting area and toilet facilities shall be provided adjacent to the treatment area.

~~*(2) Where required by the hospital ICRA (see Section 1.2-4.2), special measures to reduce the risk of airborne infection transmission shall be provided in the emergency department waiting area.~~

~~**A2.2-3.1.3.4 (2)** Measures to reduce the risk of airborne infection transmission may include enhanced general ventilation and air disinfection similar to inpatient requirements for airborne infection isolation rooms. See the CDC documents "Guidelines for Preventing the Transmission of *Mycobacterium tuberculosis* in Health-Care Settings" and "Guidelines for Environmental Infection Control in Health-Care Facilities."~~

***2.2-3.1.3.6 Treatment room or area**

A2.2-3.1.3.6 When possible, multiple-patient treatment areas should be limited in favor of enclosed single-patient treatment rooms to help limit the potential for infection transmission. Even if these rooms are not designed as airborne infection isolation rooms, their use can provide the opportunity to separate airflow and enable focused cleaning of the space between patients.

Table 2.1-1 Electrical Receptacles for Patient Care Areas in Hospitals [table excerpt]

Section	Location	Number of Single Receptacles[1]	Receptacle Locations
PATIENT BED LOCATIONS			
2.1-2.4.2	All room[2]	12	2 at each side of the head of the bed 2 on all other walls 1 for a television, if used 1 for each motorized bed 1 dedicated for ventilator
2.2-2.2.2	Medical/surgical unit patient room[2]		
2.2-2.2.4.4	Protective environment room[2]		
2.2-2.5.2	Intermediate care unit patient room		
2.2-2.9.2.2	Postpartum unit patient room[2]		
2.2-2.11.2	Pediatric and adolescent unit patient room[2]		
2.6-2.2.2	Rehabilitation unit patient room		
2.2-2.6.2	Intensive ~~Critical~~ care unit (ICU) patient room	16	Convenient[3] to head of bed with one on each wall 1 dedicated for ventilator for ICU patient rooms
2.2-2.7.2	Pediatric critical care unit patient room		
2.2-2.8.2	Neonatal intensive care unit (NICU) patient care station	16	Convenient[3] to head of bed with one on each wall
2.2-2.9.3	LDR/LDRP room	16	8 convenient[3] to head of mother's bed 1 dedicated for ventilator 4 convenient[3] to each bassinet with one on each wall

[1] Permanently installed single, duplex, or fourplex receptacles or a combination of these shall be permitted. Receptacles in relocatable power taps or mounted on portable equipment shall not be counted as part of the total minimum requirement.

[2] Omission of receptacles from exterior walls in patient rooms shall be permitted where construction or room configuration makes installation impractical.

[3] "Convenient" in this table means the cords from the equipment to be used in the room can reach the receptacles without causing a trip hazard.

[4] The number of receptacles for these spaces is intended to agree with the number required in the governing edition of NFPA 99: *Health Care Facilities Code*.

Notes

1. Consideration shall be given to providing some outlets on emergency power and some on normal power at the head of patient beds and in operating rooms, cesarean delivery rooms, and trauma/resuscitation emergency rooms in case of transfer switch failure.
2. Each patient bed location or procedure room shall be supplied by at least two branch circuits, one from the essential electrical system and one or more from the normal system. Critical care locations served from two separate transfer switches on the essential electrical system shall not be required to have separate circuits from the normal system.
3. Branch circuits serving only special purpose receptacles or equipment in critical care areas shall be permitted to be served by other panelboards.
4. An additional outlet shall be provided for a television if one is furnished in the room.
5. A minimum of one dedicated circuit shall be provided to each critical care patient location.
6. Open heart post-anesthesia recovery spaces require more receptacles than those specified in this table; the number should be determined during the planning phase.

Table 2.1-3 Station Outlets for Oxygen, Vacuum (Suction), Medical Air, and Instrument Air Systems in Hospitals[1] [table excerpt]

Section	Location	Oxygen	Vacuum	Medical Air	WAGD[2]	Instrument Air
PATIENT CARE UNITS						
2.1-2.4.2	Airborne infection isolation (AII) room	1/bed[X]	1/bed[X]	—	—	—
2.2-2.2.2	Patient room (medical/surgical)	1/bed[X]	1/bed[X]	—[3]	—	—
2.2-2.2.4.4	Protective environment room	1/bed[X]	1/bed[X]	—	—	—
2.2-2.5.2	Intermediate care room	2/bed[X]	2/bed[X]	1/bed[X]	—	—
2.2-2.6.2	Critical care patient room	3/bed[X]	3/bed[X]	1/bed[X]	—	—
2.2-2.6.4.2	Critical care AII room					
2.2-2.7.2	Pediatric critical care room					
2.2-2.8.2	Neonatal intensive care unit (NICU) infant care bed	3/infant care bed	3/infant care bed	3/infant care bed	—	—
2.2-2.9.2	Antepartum and postpartum unit	1/bed[X]	1/bed[X]	—	—	—
2.2-2.9.3	Labor/delivery/recovery (LDR)					
2.2-2.9.3	Labor/delivery/recovery/postpartum (LDRP)					
2.2-2.9.11.1	Infant resuscitation space	3/bassinet	3/bassinet	3/bassinet	—	—
2.2-2.9.11	Cesarean delivery room	2/room[X]	4/room[X]	1/room[X]	—	—
2.2-2.9.11.11	Recovery space for cesarean delivery	1/bed[X]	3/bed[X]	1/bed[X]	—	—
2.2-2.10.3.1	Newborn nursery	1/bassinet[5]	1/bassinet[5]	1/bassinet[5]	—	—
2.2-2.10.3.2	Continuing care nursery	1/bassinet	1/bassinet	1/bassinet	—	—
2.2-2.11.2	Pediatric and adolescent patient room	1/bed[X]	1/bed[X]	1/bed[X]	—	—
DIAGNOSTIC AND TREATMENT LOCATIONS						
2.1-3.2	Examination room or emergency department treatment room	1/room[X]	1/room[X]	—	—	—
2.1-3.4.4	Phase I post-anesthesia (PACU) patient care station	2/station[X]	3/station[X]	1/station[X]	—	—
2.1-3.4.5	Phase II recovery patient care station	1/station[X]	1/station[X, 6]	—	—	—
2.2-3.1.2.6	Treatment room for basic emergency services	1/gurney[X]	1/gurney[X]	—	—	—
2.2-3.1.3.3	Triage area (emergency department)	1/station[X]	1/station[X]	—	—	—

Table 2.1-3 Station Outlets for Oxygen, Vacuum (Suction), Medical Air, and Instrument Air Systems in Hospitals[1] [table excerpt] *(continued)*

Section	Location	Oxygen	Vacuum	Medical Air	WAGD[2]	Instrument Air
2.2-3.1.3.6	Emergency department treatment room or area	1/gurney[X]	1/gurney[X]	1/gurney[X]	—	—
2.2-3.1.3.6 (4)	Trauma/resuscitation room	2/gurney[X]	3/gurney[X]	1/gurney[X]	—	—
	Plaster and cast room	1/room[X]	1/room[X]	—	—	—
2.2-3.2.2	Observation unit patient care station	1/station[X]	1/station[X]	—	—	—
Table 2.2-2	Class 1 imaging room	1/room[X]	1/room[X]	—	—	—
2.2-3.3.2 Table 2.2-2	Procedure room Class 2 imaging room	2/room[X]	2/room[X]	1/room[X]	—	—
2.2-3.3.3 Table 2.2-2	Operating room Class 3 imaging room	2/room[X]	5/room[X]	1/room[X]	1/room	—
2.2-3.11.2	Endoscopy procedure room	1[X]	3[X]	—	—	—
2.2-3.11.3	Endoscopy pre- and post-procedure patient care area	0[X,7]	0[X,7]	—	—	—
2.2-3.13.4	Hyperbaric suite pre-procedure patient care area	2[X]	2[X]	—	—	—
2.5-3.4.2.2	Electroconvulsive therapy treatment room	1[X,9]	1[X,9]	—	—	—

[1]For any area or room not included in this table, the facility clinical staff shall determine station outlet requirements after consultation with the authority having jurisdiction.

[X]Provision of an additional station outlet shall be considered to accommodate ventilator use during an emergency condition and future equipment that may require more access to these medical gases.

[2]WAGD stands for "waste anesthesia gas disposal" system.

[3]Medical air outlets may be required in patient rooms.

[4]When infant resuscitation takes place in a room such as a cesarean delivery room or an LDRP room, infant resuscitation services must be provided in that room in addition to the minimum service required for the mother.

[5]Four bassinets may share one outlet that is accessible to each bassinet.

[6]If the Phase II recovery area is combined with the PACU, three vacuum outlets per bed or station shall be provided.

[7]A portable source shall be available for the space.

[8]Vacuum and/or instrument air shall be provided if needed for the cleaning methods used.

[9]Use of portable equipment in lieu of a piped gas system shall be permitted.

[10]In the one-room sterile processing facility and the clean workroom of the two-room sterile processing facility, an instrument air outlet or portable compressed air shall be provided as required by the equipment used. In the decontamination room of the two-room sterile processing facility, an instrument air outlet or portable compressed air is required.

[11]NFPA 99 permits the use of portable medical compressed air for single applications. Where cylinders are used for non-respiratory purposes, such as air for blowing down scopes and/or running decontamination equipment, NFPA 99 should be consulted for cylinder air quality, placement, and handling.

Chapter 6: Small and/or Rural Health Care Facilities

The small and/or rural health care facilities subcommittee sought to create a clear definition for this health care facility type while documenting the quantity and distribution of these facilities across the United States. For the basis of the subcommittee's work, the definition of small and/or rural health care facilities is as follows: "Small inpatient (35 beds or less) and outpatient facilities located in rural or urban areas. Many of these facilities serve communities with limited medical resources."

Because the subcommittee focused on small facilities located in urban settings as well as those in remote settings, the "and/or" included in the definition is critical. The size limitation of 35 beds aligns with regulations for critical access hospitals (CAH), which has a limit of 25 inpatient beds with an additional 10 beds permitted for psychiatric or rehabilitation inpatient care. This limitation focuses the scope of this chapter and helps ensure commensurate scale for analysis between CAHs and other small hospitals.

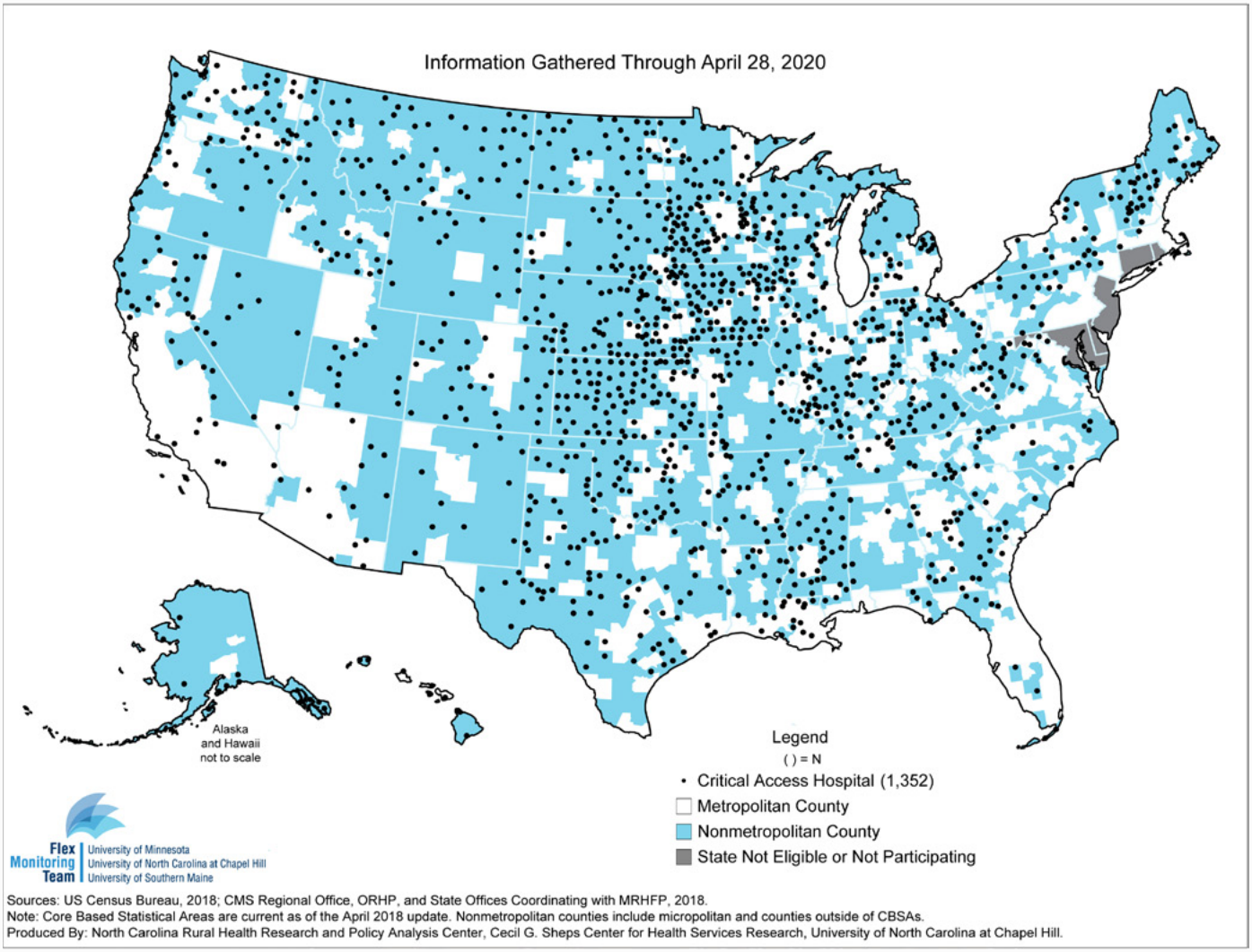
The "small and/or rural" facility designation also applies to "micro hospitals" and other "boutique" health care facilities that have sprung up over the past several years in states such as Nevada, Arizona, Colorado, California, Texas, Kansas, and Indiana. As CNBC reported in 2018, "Micro hospitals are emerging in some suburban and urban markets as a backup to community facilities—or in regions where there is not enough demand for full-sized hospitals. The facilities range from 15,000 to 60,000 square feet, substantially smaller than community hospitals, and offer as few as eight beds."[1]

Characteristics of Small and/or Rural Health Care Facilities

As mentioned, small health care facilities such as those discussed in this chapter appear in both rural and urban areas in the United States. Critical access hospitals[2] must be located 35 miles from another hospital and length of stay for acute care patients must be less than 96 hours. According to data collected by Flex Monitoring Team (2020), as of April 28, 2020, there were 1,352 CAHs around the nation (Figure 6-1).

In addition to CAHs and other small inpatient facilities, the small and/or rural health care subcommittee reviewed emergency preparedness and response planning for outpatient facilities through the lens of risks and unique challenges, or "disrupters." These facility types include rural health clinics, federally qualified clinics, and ambulatory surgery centers as well as residential health care facilities (e.g., nursing homes and assisted living facilities) in non-metro and underserved urban areas. The geographic distribution of non-metro federally qualified clinics (Figure 6-2), rural health clinics (Figure 6-3), nursing homes (Figure 6-4), and Indian Health Service (IHS) health care facilities (Figure 6-5) is shown in the cited figures. All facility types listed may be called on in times of disaster, and their unique characteristics and commonalities were key to both interpreting study findings and writing proposed changes to the *Guidelines* documents.

Figure 6-1: Location of Critical Access Hospitals in the United States



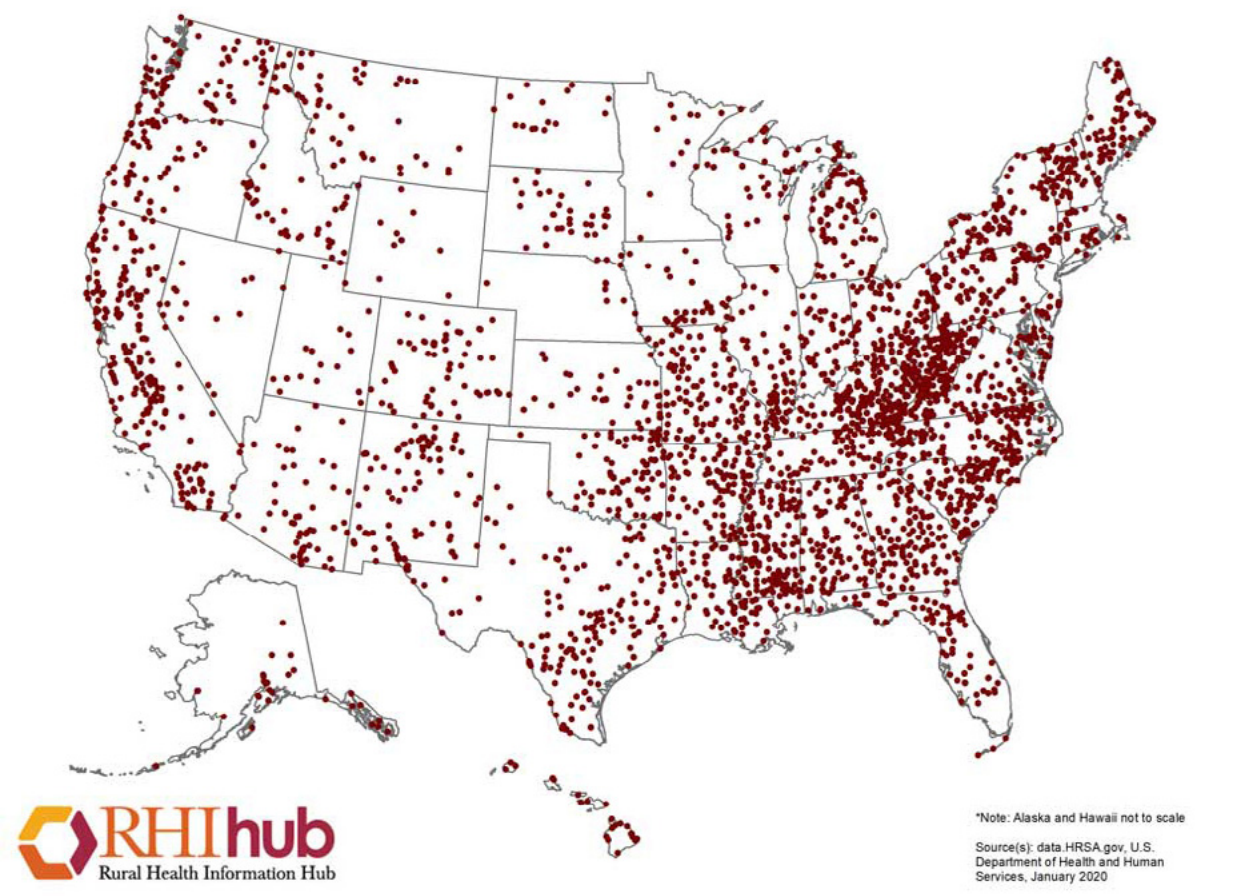
Source: Flex Monitoring Team

What Is a "Disrupter"?

As defined in the glossary of this white paper, disrupters are "material or operational challenges and/or conditions that, when left unaddressed, may negatively affect the delivery of patient care during an emergency event." Potential disrupters include external events (e.g., a disaster or epidemic in the community that causes multiple casualties), internal emergencies (e.g., events within the hospital such as bomb threats,

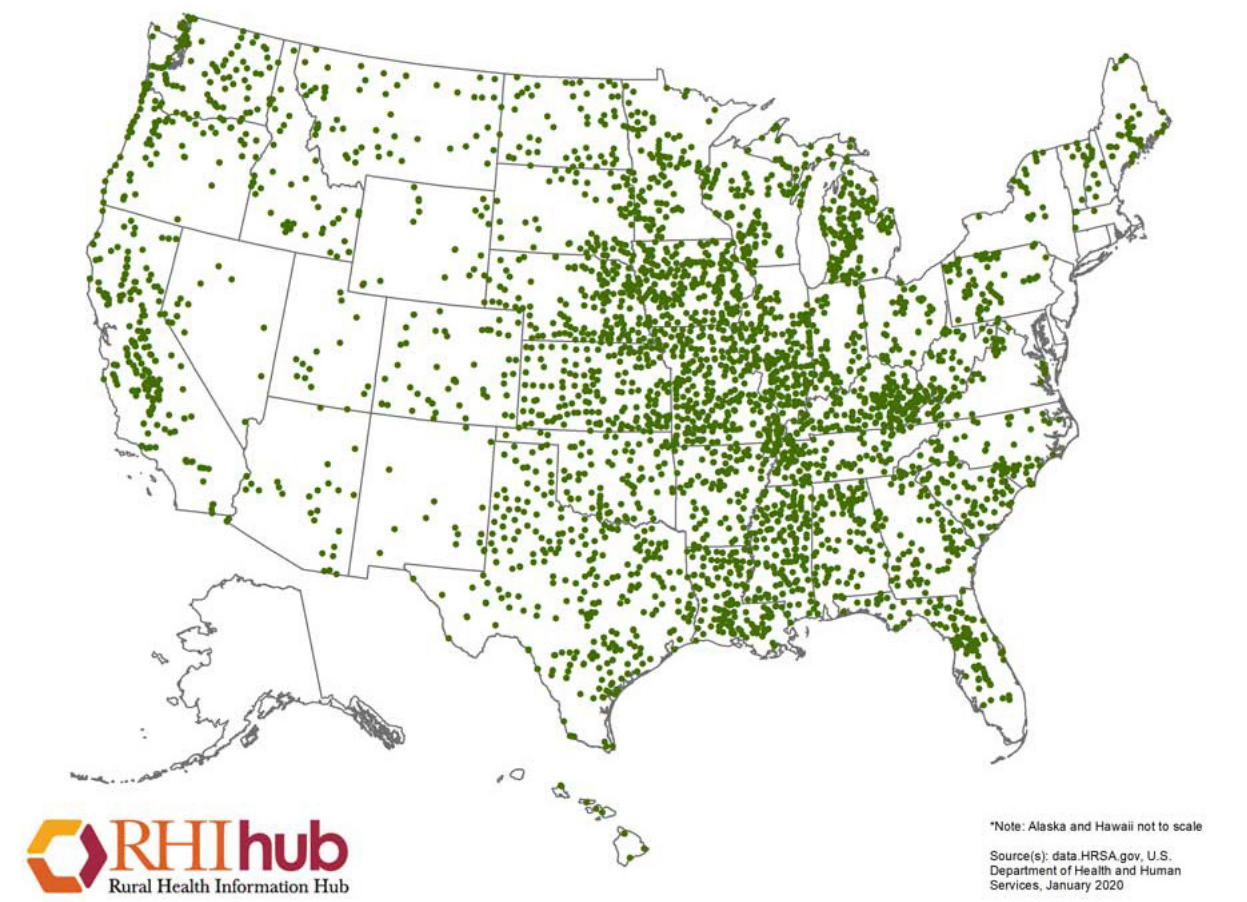
fires, explosions, radioactive spills, or utility disruptions), and weather emergencies (e.g., snowstorms, floods, hurricanes, or other acts of nature that severely impair normal operations).

Figure 6-2: Location of Federally Qualified Health Center Sites Outside Urbanized Areas



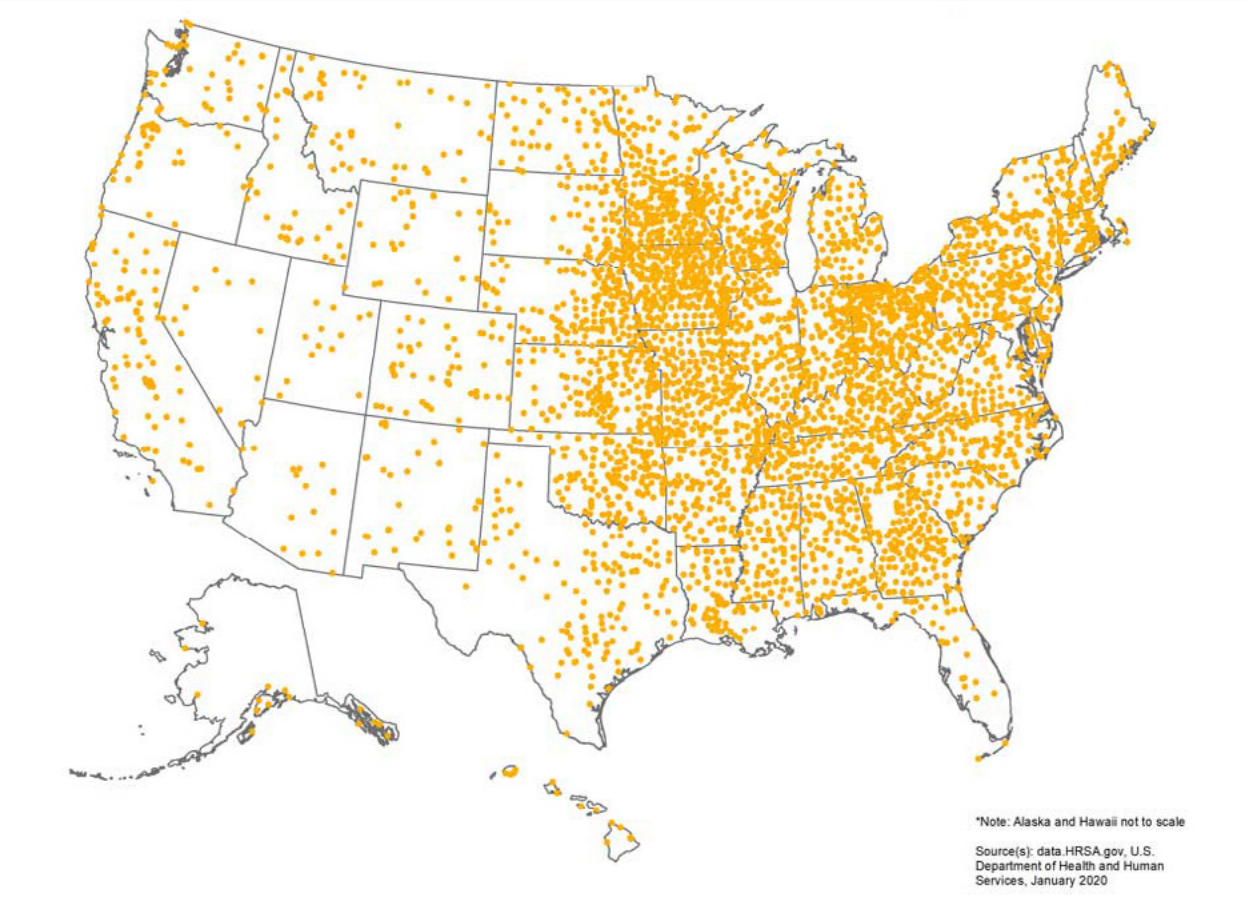
Source: Rural Health Information Hub, https://www.ruralhealthinfo.org/rural-maps/mapfiles/federally-qualified-health-centers.jpg?v=8

Figure 6-3: Location of Rural Health Clinics



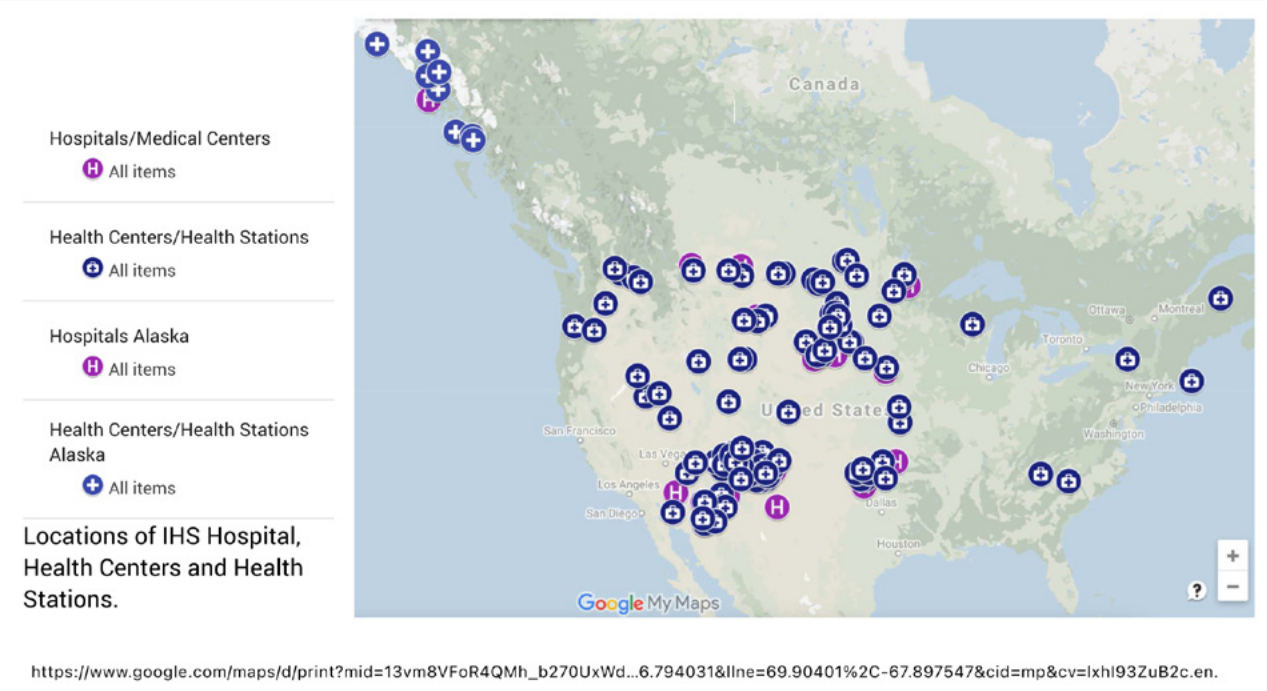
Source: Rural Health Information Hub, https://www.ruralhealthinfo.org/rural-maps/mapfiles/rural-health-clinics.jpg?v=8

Figure 6-4: Location of Skilled Nursing Facilities Outside of Urbanized Areas



Source: Rural Health Information Hub, https://www.ruralhealthinfo.org/rural-maps/mapfiles/skilled-nursing-facilities.jpg?v=8

Figure 6-5: Location of Indian Health Services Facilities

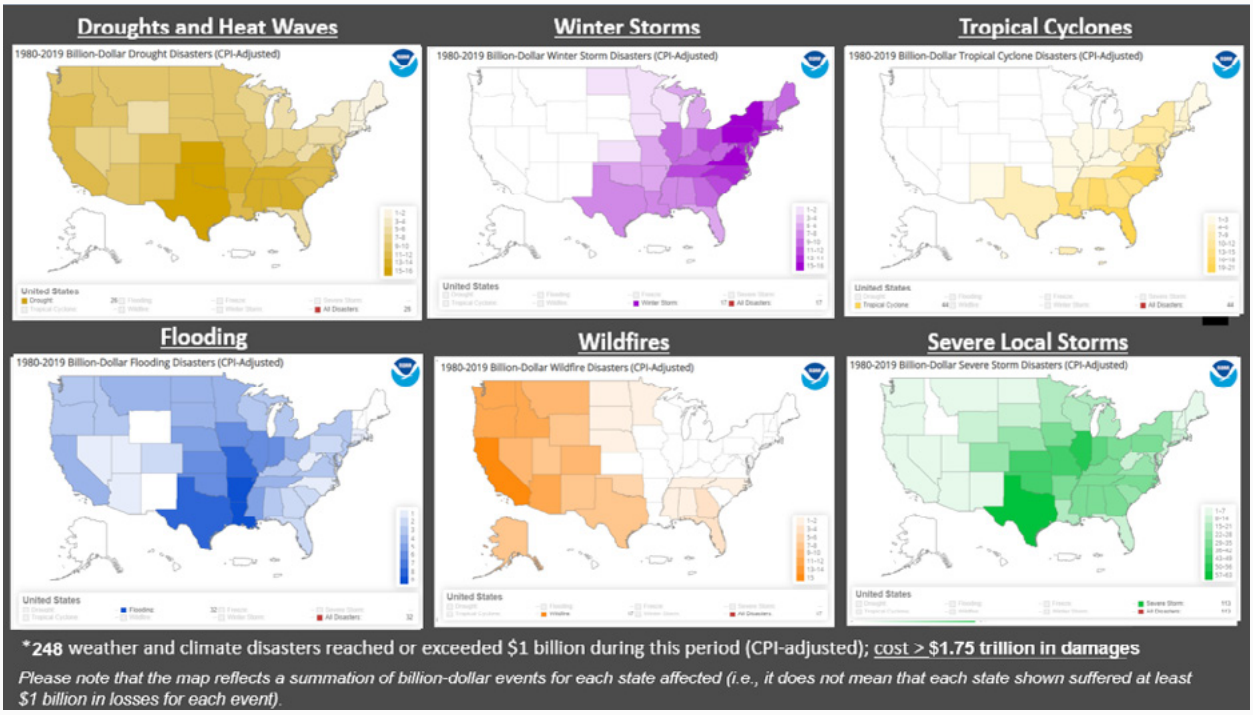


Source: https://www.google.com/maps/d/edit?mid=13vm8VFoR4QMh_b270UxWdYz2TY2Ffw_w&usp=sharing, Accessed June 19, 2020

Emergency Conditions that Threaten Rural Areas

A review of the weather and climate disasters in the United States in the past 40 years (Figure 6-6), considering their frequency and where they have occurred, illustrates the extent to which rural areas have been severely affected by these major events. It is likely that such events will continue to increase due to the effects of climate change.

Figure 6-6: Billion-Dollar Weather and Climate Disaster Frequency Maps, 1980-2019

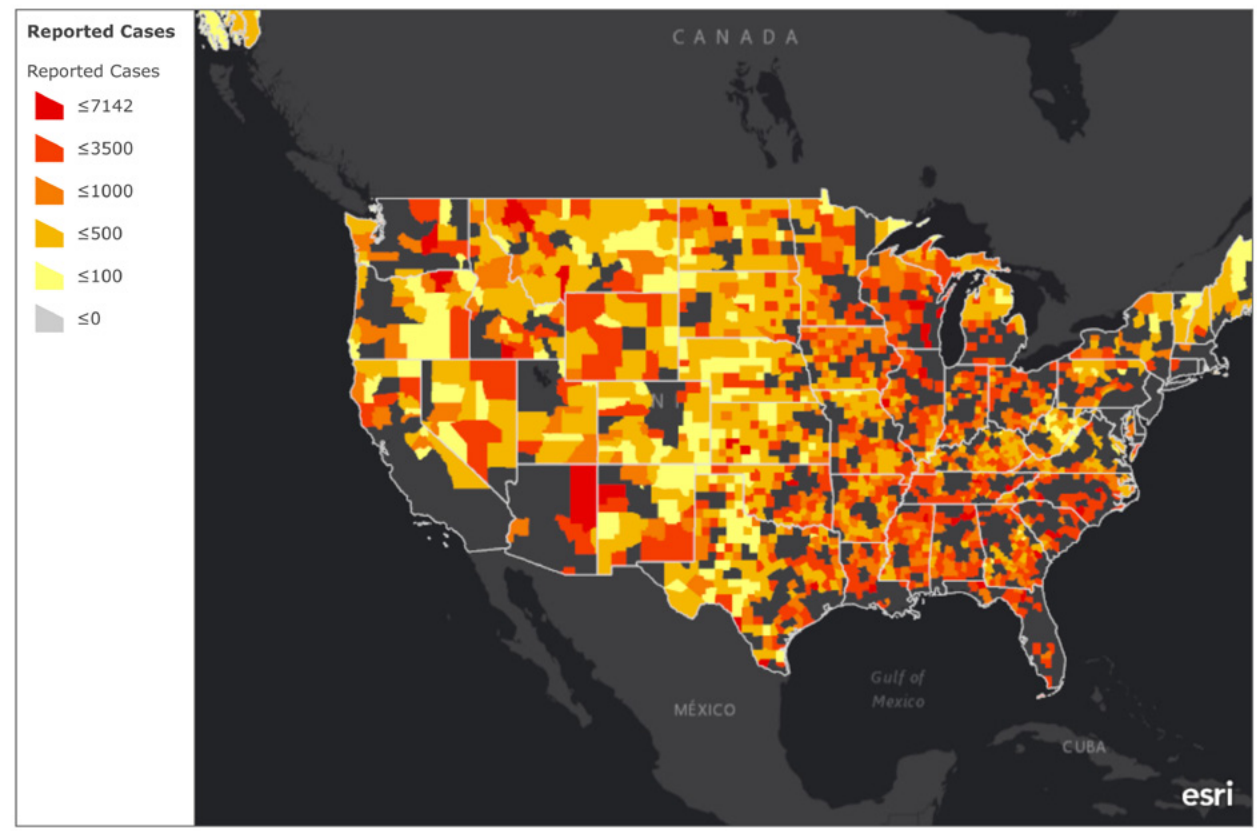


These maps show the number of times six types of weather and climate disasters occurred in each state from 1980 to 2019.

Source: NOAA National Centers for Environmental Information, "Billion-Dollar Weather and Climate Disasters" https://www.ncdc.noaa.gov/billions/mapping/freq/1998-2020

Epidemics and pandemics (e.g., avian flu and COVID-19) can also adversely affect rural areas. According to the Housing Assistance Council, as of November 15, 2020, more than 1.6 million reported cases of coronavirus disease 2019 (COVID-19) and more than 24,000 associated deaths (Figure 6-7) had been reported in rural communities.[3] As Figure 6-7 indicates, states with more rural hospitals and lower hospital operating margins have tended to have greater COVID-19 vulnerability based on the COVID-19 Community Vulnerability Index.[4]

Figure 6-7: COVID-19 Cases Outside U.S. Metropolitan Areas, November 15, 2020



Source: Housing Assistance Council

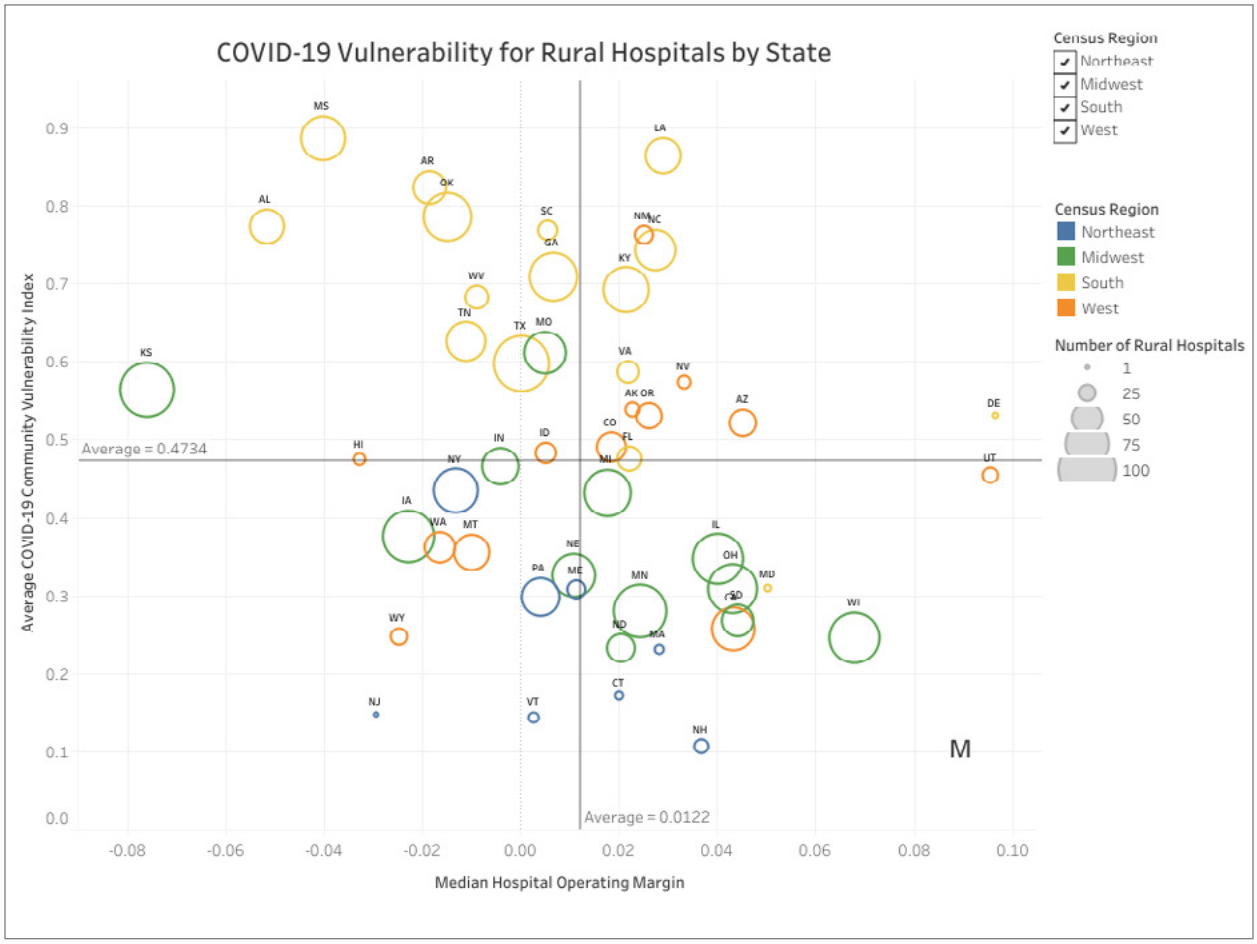
Economic Challenges Inherent in Small and/or Rural Health Care Facilities

Regardless of economic conditions, small and/or rural facilities almost always start out with a financial disadvantage given their lower profit margins and higher costs of operation when compared to large health care facilities in urban areas (Figure 6-8). Profit margins in rural facilities are a third of those for large facilities in urban areas (Figure 6-9).

These inherent economic disadvantages are exacerbated by federal reimbursement programs and their effect on small and/or rural health care facilities. By recognizing the current limitations

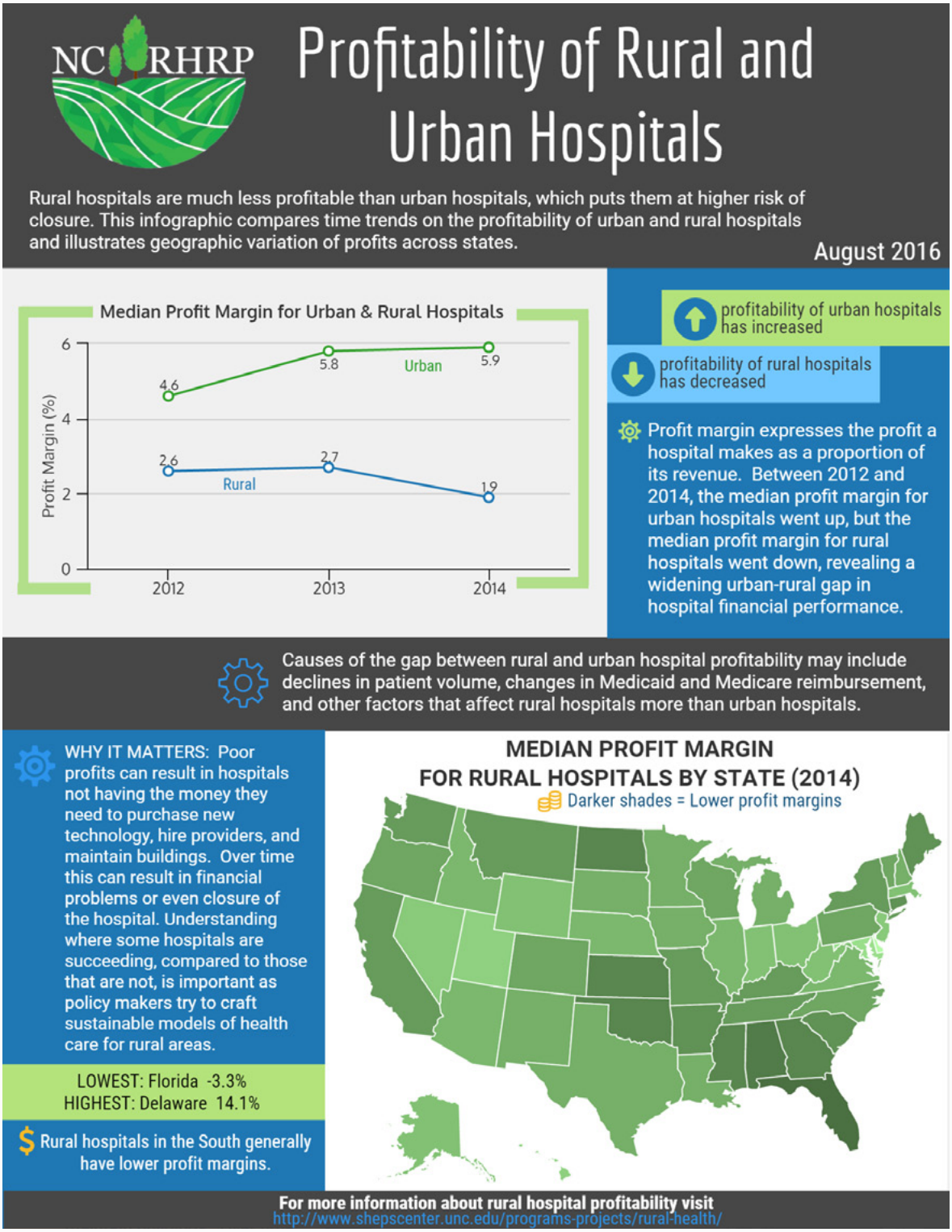
caused by reimbursement programs as a potential disrupter to the effectiveness of a facility's disaster response, this white paper integrates and assumes this impact in the proposed changes to the *Guidelines* recommended by this subcommittee.

Figure 6-8: COVID-19 Rural Hospital Vulnerability Index



Source: Sheps Center for Health Services Research, University of North Carolina, 2020

Figure 6-9: Median Profit Margin for Urban and Rural Hospitals



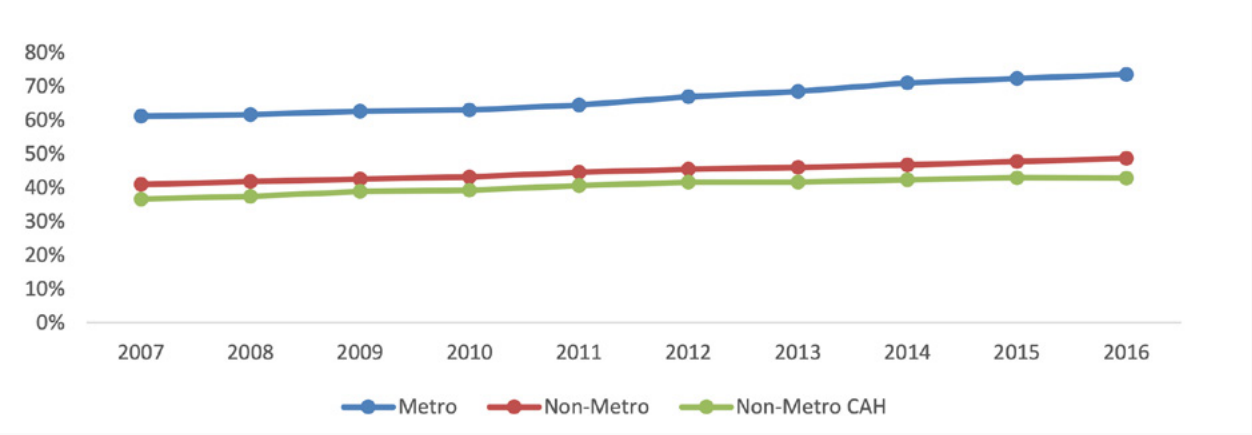
Source: Sheps Center for Health Services Research, University of North Carolina, 2016

Health Care System Affiliation

Affiliation with a larger health care system allows critical access hospitals to have easier "access to technology, staff recruitment and retention, expanded health care and operational services, group purchasing, and reduced cost of capital," according to the paper "The Rural Hospital and Health System Affiliation Landscape" from the Rural Policy Research Institute (RUPRI).[5] Data from RUPRI show an increasing trend in system affiliation among CAHs from 2007 to 2016, with non-metropolitan CAH system affiliation increasing from 40.9 percent to 48.6 percent. Nonetheless, more than half the CAHs continue to operate independently.[6]

During emergency conditions, affiliation with a health care system can enhance the ability of a small CAH to respond to the crisis by providing support for patient transfer, access to medical staff, and technology. Independent CAHs are likely to struggle during crises due to greater challenges stemming from lack of resources that are more available in a health care system.

Figure 6-10: Trends in Hospital System Affiliation, 2007–16



Source: Rural Policy Research Institute, "The Rural Hospital and Health System Affiliation Landscape, Figure 1, 2018

Facility and Resource Constraints in Rural Emergency Preparedness and Response

The 2002 report "Rural Communities and Emergency Preparedness," prepared by the Health Resources and Services Administration's Office of Rural Health Policy,[7] suggests the infrastructure to respond to emergency conditions (e.g., a terrorist or bioterrorism event) is either very limited or nonexistent in rural areas. Rural health care facilities have limited ability to decontaminate, isolate, and quarantine patients; insufficient beds to treat large numbers of victims; and a shortage of personnel with emergency response expertise.[8]

A 2007 study of the disaster preparedness of rural hospitals in the United States, which was based on original data collection and secondary data analysis using the "National Study of Rural Hospitals" from John Hopkins University, also showed that rural hospitals reported low preparedness (64 percent) in surge capacity.[9] A 2018 study conducted by the National Association of County & City Health Officials[10] identifies a number of challenges that affect the efforts of rural health care coalitions to coordinate health care system readiness and response; these include lack of capacity, funding, and resources; technology constraints, such as poor cellular coverage and lack of access to alternative systems during power and technology system outages; and geographic isolation and transportation barriers.

In a 2007 study that shared lessons learned from a rural community hospital emergency department (ED) disaster drill based on a mass-casualty bioterrorism event, several facility limitations were identified as potential disrupters that could limit health care workers' ability to respond to such events.[11] The disrupters cited in the report indicated the lack of:

- Appropriate and proximate personal protective equipment (PPE) storage

- Space in decontamination areas for a shower room large enough to accommodate both a stretcher and the two people required to properly decontaminate a patient
- Security personnel needed to monitor and enforce changes in hospital access points to prevent contamination of patients, visitors, and staff
- Planned coordination procedures between rural hospitals and nearby hospitals for patient transfer, highlighting the importance of collaboration with regional emergency medical services (EMS) and the regional or state hospital association

A large nationwide survey[12] to evaluate the emergency preparedness of EDs in rural hospitals, published in 2006, shows that rural hospitals have limited capacity to manage complex emergency events and cannot accommodate a sudden, very large surge of patients. Of the 941 responding hospitals, 95 percent reported their EDs would be overwhelmed by 10 or fewer critically ill or injured patients arriving simultaneously.

A study of rural area options for increasing bed availability in response to a medical surge[13] published in 2014 identified common challenges during disaster conditions. These include remote location, geographic barriers, limited access to real-time information, and lack of clear guidance for altered standards of care. The study emphasized the lack of resources, including funding, space, equipment, and medical personnel, as a major impediment to emergency planning and response.

These existing studies have shown that although small rural facilities are as essential as their larger urban counterparts in responding to emergency conditions, they lack the resources to provide care directly in the community for a sizable event of any duration. Each facility faces unique challenges, and all of them should prioritize their top issues for emergency preparedness and response.

Subcommittee Methodology

Between March and August 2020, a subcommittee of diverse experts directly linked to small and/or rural health care was convened as part of the FGI Emergency Conditions Committee to provide recommendations on how these facilities can better prepare for and respond to potential emergency conditions. The subcommittee participants included certified health care architects, authorities having jurisdiction (AHJs), health care industry representatives, experts in mechanical and electrical systems, and a doctor of evidence-based health care design with a specialty in architectural impacts on rural health care outcomes.

The subcommittee established a research mission of basing its *Guidelines* recommendations for disaster response on the measurement of disrupters (i.e., unique challenges) that create barriers for disaster response in the unique settings of small and/or rural health care facilities. By first analyzing these disrupters and associated vulnerabilities, the subcommittee sought to write improved *Guidelines* language to address each of these specific barriers.[14] The group's talent spectrum fostered the diversity of opinion needed to evaluate and prioritize the vulnerabilities, and this strategy allowed for data to be collected and prioritized through the lens of the potential disrupters.

A mixed-method approach was used to develop this chapter of the white paper, relying on qualitative and quantitative research methods that included expert panel discussion and interviews and surveys with hospital facility administrators. This exploration focused on the potential disrupters to effective disaster response that may arise from the scale or relative isolation of many small and/or rural health care facilities.

The subcommittee met weekly and followed these research steps:

Step 1: Define "disrupters." A definition of "disrupters" as they apply to the disaster responses of small and/or rural health care providers was developed and approved.

Step 2: Create a list of disrupters that affect disaster response. Based on expert knowledge, five disrupter categories were established:

- Policy/reimbursement
- Economic
- Access/site
- Utilities and associated costs
- Partner and community resources

Step 3: Create a disrupter matrix. The members of the subcommittee and a select group of practicing architects who specialize in small and/or rural hospitals were invited to independently rank the importance of each potential disrupter on a 1-5 scale, with 5 indicating the largest impact and 1 the least disruption (Table 6-1). This ranking established how the importance of potential disrupters to operations was weighed for each facility type (CAHs, non-CAH small rural hospitals, rural clinics, small urban hospitals, small urban/suburban hospitals, small urban/suburban specialty hospitals, and small urban/suburban clinics).

Step 4: Interview health care facility personnel. A questionnaire was created to give interviewers a standard data-gathering format. This step helped the group test the identified disrupters.

Step 5: Summarize and evaluate the disrupter matrix data. The values determined by ranking the data in the disrupter matrix illuminated not only the facilities' highest level of vulnerability to each of the five categories but also trends, patterns, and linkages between the strengths and weaknesses. The data were then used to set priorities for revised *Guidelines* language.

Step 6: Summarize and evaluate the interview data. The facility personnel interview responses were collected and analyzed, and results were organized into a standard format for comparing lessons learned from various facilities. Themes identified from the interviews also helped set priorities for revising the *Guidelines* text.

Table 6-1: Emergency Response Disrupters Matrix

Emergency Response Disrupters Matrix

Compiled Ratings for Emergency Response Disrupters for Small and/or Rural Health Care Facilities

#	Category	Disrupter Items	Rural*			Urban/Suburban				
			CAH (IP)	Small (IP)	Clinic (OP)	Small (IP)	Small Specialty (IP)	Clinic (OP)	avg.	STDEV
1	Policy/reimbursement									
		CAH reimbursement advantage	29	28	12	23	21	18	21.83	6.369
		Impact of CMS rules and regulations (Medicare/Medicaid)	38	38	34	35	31	30	34.33	3.386
		Eligibility for federal stimulus funds	36	37	38	32	34	35	35.33	2.160
		Access to emergency relief funds	38	38	39	34	35	33	36.17	2.483
		Underserved populations incentive program (Census)	32.5	32.5	32.5	31	33	32	32.25	0.689
	Sum		173.5	173.5	155.5	155	154	148		
	Average		34.7	34.7	31.1	31	30.8	29.6	31.98	2.172
2	Economic									
		Impact of poverty (insured versus uninsured)	39	42	40	39	33	34	37.83	3.545
		Facility limitations (e.g., older facility, size issues, infrastructure issues)	43	41	39	38.5	36.5	36.5	39.08	2.558
		Access to grants or financing options	30	33	32	29	29	30	30.50	1.643
		Access to resource plentiful community with large tax basis	29	20	24	21	21	21	24.00	3.688
		Multigenerational households (i.e., crowding)	34	34	33	31	31	31	32.33	1.506
		Traditionally low profit margins	37	38	38	31.5	30.5	32.5	34.58	3.456
		Disproportionate elderly demographic	40	41	41	31	31	31	35.83	5.307
	Sum		252	257	247	221	212	216		
	Average		36.0	36.7	35.3	31.6	29.6	30.9	33.34	3.018
3	Access/site									
		Proximity to population served	43	42	40	24	24	23	32.67	9.913
		Proximity to ground/air transport	42	41	38	23	23	20	31.17	10.187
		Emergency support (e.g., fire, police, EMS transportation)	39	38	36	23	23	23	30.33	8.091
		Consistent access from mobile diagnostics	41	41	36	24	24	23	31.50	8.781
		On-site decontamination support	39	39	36	33	32	31	35.00	3.521
		Limited on-site logistical support (portable/temporary structures)	39	39	31	37	35	33	35.67	3.266
		Provision of on-site helipad for patient transfer	39	39	28	29	28	25	31.33	6.088
	Sum		282	279	245	193	189	178		
	Average		40.3	39.9	35.0	27.6	27.0	25.4	32.52	6.716
4	Utilities and associated costs									
		Availability, uninterrupted broadband service	49	49	47	28	28	27	38.00	11.349
		Telephone (landline) or cell phone coverage	42	42	40	27	23	26	33.33	8.092
		Water and sewer availability/capacity	34	34	31	24	24	23	28.33	5.241
		Natural gas availability/capacity	33	33	30	26	26	24	28.67	3.882
		Medical gas availability/capacity	41	41	29	30	30	23	32.33	7.202
		Generator and oxygen fuel source proximity	43	42	33	36	36	28	36.33	5.610
		Waste disposal availability	32	32	28	26	26	23	27.83	3.601
	Sum		274	273	238	197	193	174		
	Average		39.1	39.0	34.0	28.1	27.6	24.9	32.12	6.155
5	Partner and community resources									
		Affiliation to associated facility or higher acuity	38	36	36	22	22	21	29.17	8.256
		Availability of support from partnering system	39	39	36	30	30	29	33.83	4.708
		Food supply access	38	37	28	35	35	27	33.33	4.676
		Available staff (all levels)	49	49	45	38	39	36	42.67	5.750
		Specialists professional workforce and ability to supply primary care	38	37	33	26	26	24	30.67	6.121
		Opportunities for community engagement in disaster	39	39	36	30	29	27	33.33	5.317
		Limited available space or flexible space	40	39	34	37	36	30	36.00	3.633
		PPE reserve storage access	41	41	39	37	37	34	38.17	2.714
	Sum		322	317	287	255	254	228		
	Average		40.3	39.4	35.4	31.9	31.8	28.5	34.54	4.662

Highest rating

second tier highest rating

Step 7: Prioritize *Guidelines* updates for small and/or rural health care facilities. With the establishment of these priorities, the subcommittee targeted specific sections of the *Guidelines* for recommended revisions in lieu of a more general approach.

Step 8: Develop proposed *Guidelines* revision language. The subcommittee created proposals for changes to the *Guidelines* that

can facilitate disaster response for small and/or rural health care facilities. By focusing energy on the unique challenges that exist for small and/or rural health care facilities, the proposed *Guidelines* changes support improved disaster response and reduce barriers when disasters occur.

Step 9: Create a useful collection of relevant information. Data assets collected and referenced throughout the chapter and in the resources list include maps and exhibits that provide the background to this subcommittee's recommendations and establish the logic behind many of its conclusions. The subcommittee hopes this knowledge base can be applied to a wide range of facility types and situations; the information included will inform revisions to the 2022 *Guidelines* and future editions.

Research Results

As mentioned in the research process described above, the subcommittee and a small group of invited subject matter experts evaluated the known emergency response disrupters listed in Step 2. After their responses were combined to get the sum of the rankings for each disrupter, descriptive statistics were used to analyze the average ranking for each building type under the five disrupter categories. An average rating was calculated for each disrupter by combining ratings for all indicated facility types.

The standard deviation for each disrupter was calculated to evaluate the building type's variance from the mean score. A lower standard deviation indicates closer consensus across building types for small and/or rural health care facilities (Table 6-1).

Findings Related to Differences in Urban and Rural Settings

The results summarized in Table 6-1 reveal significant emergency planning and response disruptions encountered by small rural facilities and small urban hospitals and clinics. In particular, policy

and reimbursement issues and economic conditions are high-impact disrupters for small rural health care organizations; these concerns are less significant for their urban counterparts. Small rural hospitals also are challenged by limited site support, access to utilities, and resources when compared to their urban counterparts.

Summary of Findings in Five Disrupter Categories

Among the five categories, "resources" is rated as the disrupter with highest impact, with an average rating of 34.54. This indicates that limited facility size and capacity make it more difficult for small and/or rural health care facilities to access medical and food supplies, hire and retain staff, and meet needs for surge capacity and storage—especially during lengthy emergency situations or disasters. As determined by the subcommittee's interviews, the most significant disrupters in each category are described below.

Policy/reimbursement

Among the five disrupters in the policy/reimbursement category, "eligibility for federal stimulus funds" and "access to emergency funds" are the most impactful disrupters across building types (36.17 and 35.33, respectively). As most small rural hospitals operate with very low profit margins, the ability to obtain funding during emergency events is instrumental to their survival.

"CAH reimbursement advantage" has the highest standard deviation across building types (STDEV=6.369). The CAH designation provides benefits and support to critical access hospitals. However, small and/or rural health care facilities that don't qualify for CAH designation and reimbursement benefits are vulnerable to unreimbursed losses from an emergency response.

Economic conditions

The highest disrupter in this category is "facility constraints," including outdated facilities, small hospital size, and infrastructure issues—all results of capital funding shortages (39.08). The "impact

of poverty and uninsured patients" also poses a significant threat to these facilities (37.83), but this effect varies among small urban and rural hospitals and clinics across the country and partially reflects the health of regional economies. As well, clear urban/rural differences appear regarding "proportion of elderly demographics," "low profit margins," and "access to resource plentiful communities with large tax base."

Site access

"Limited on-site logistical support, including portable and temporary structure" is the largest average disrupter for small and/or rural health care facilities (35.67). However, when rural and urban/suburban small hospitals are studied separately, the largest challenge for small rural hospitals is their remote location. The highest-rated disrupter for rural hospitals is "proximity to ground/air transport," followed by "proximity to the population served," "emergency support (fire, police, EMS transportation)," and "consistent access from mobile diagnostics." These disrupters were rated as much higher and more challenging for small rural hospitals and clinics than for hospitals and clinics in urban/suburban areas.

Utilities and associated costs

"Availability and reliability of uninterrupted broadband services" is rated as the highest utility disrupter among all items for small and rural hospitals, CAHs, and clinics. Lack of broadband in rural areas makes this disrupter the largest disparity between urban and rural facilities. "Generator and oxygen fuel source proximity" is also an impactful disrupter for small and/or rural health care facilities during emergency events.

Partner and community resources

"Available staff," "access to PPE reserve storage," and "limited available space or flexible space" are the top three disrupters in the resources category. Concerns about supply chain deficiencies and lack of access to PPE reserve storage during emergency conditions are more pronounced in remote locations; emergency planning and response considerations in these vulnerable facilities should include

provisions for anterooms and storage spaces. Nearly all small and/or rural health care facilities have limited space for surge capacity; thus, flexible use of space during emergency situations is key to successfully accommodating surge patient volume.

"Operational affiliation with facilities of higher acuity" appears to significantly improve emergency response benefits for most small and/or rural facilities. For urban/suburban facilities that have robust supply chain connections, the relative benefit of operational affiliations is much less.

Key Themes for Interpreting the Data

Based on the findings illustrated in Table 6-1, three major disrupter themes emerged for small and/or rural health care facilities. The subcommittee summarized these themes as issues related to:

- **Getting there:** Site access, use, and flexibility; the number of nearby residential accommodations, inclusive of all overnight accommodations including rentals, hotels, and seasonal recreational areas; existing community infrastructure; and travel distance to a medical facility. The lack of transportation options combined with travel distance from patients' homes present a barrier to access.
- **Connection:** Lack of reliable broadband capability and supporting technology
- **Facility constraints:** Limited financial resources; aging and outdated facilities; a lack of facility adaptability and flexibility; and infrastructure that incurs higher costs for corrective measures

Interviews with Hospital Administrators

The subcommittee conducted interviews with hospital administrators and facility managers. Selected hospitals included large teaching hospitals, small community hospitals, and CAHs. Interviews were designed to gather lessons that small and/or rural

hospitals learned during the COVID-19 crisis and to identify key strategies that could allow these facilities to respond more effectively to future emergency events. The interviews revealed several findings consistent with the disrupter matrix (Table 6-2). Interview insights discussed below are grouped by the three key themes from the disrupter matrix findings.

Getting There

The insights in this section are related to the location of the hospital or health care facility.

Flexible site

An interview with a CAH facility located northwest of Wichita Falls, Texas, revealed that having site flexibility facilitated effective adaptation to the crisis event. For example, prior to the pandemic, the health care organization had the foresight to conveniently locate a storage container on the hospital property. Power was provided to the location to allow for conditioning of the storage container and to regulate temperatures within it. This unit could be used for stockpiling supplies such as surplus PPE during crisis events.

Patient receiving/flow adaptations

At the same CAH in Wichita Falls, Texas, the adaptable site concept was expanded to accommodate a revised patient flow for intake and triage. A separate centralized receiving and triage station was set up at the front door (away from the ED). Patients were screened and directed to a care path based on their assessment and level of perceived need. The site was used to accommodate patients waiting inside their vehicles, both for initial screening and while awaiting a care path directive. Patients were routed to other parts of the site for testing or admitted to the facility through a strategically located entry. Having adequate flexible space around the building was critical to support these additional activities and functions.

Supply chain surplus and redundancy

As one emergency management director stated, "At the onset of the pandemic, it was difficult to get supplies from vendors who were also experiencing supply disruptions. There were clear benefits from having multiple supply chain sources and vendor flexibility and redundancy to meet the demand and maintain ongoing hospital operations." Having a surplus of on-site storage enabled the organization to store excess supplies and meet demand despite the unpredictability and uncertainty associated with supply chain disruption, exhaustion, or depletion.

The importance of food services in an emergency setting was stressed in another interview with a health care organization in rural Indiana. Although most efforts during an emergency focus on assuring continuity of clinical services, ensuring continuity of food services to staff and patients is equally important. In many cases, these essential nutritional services extend beyond the hospital to vulnerable members of the community who rely on these services. During an emergency event, provisions are needed for food storage and soft supplies, including disposable silverware, trays, and other equipment that enables food delivery to patients, staff, and the surrounding community.

Connection (Broadband and Cellular Service Reliability)

Rural broadband is challenged with aging infrastructure and difficult terrain in remote areas. State and federal programs provide funding for broadband access to rural health care and education facilities. An interview was conducted with a telecommunications vice president who works with a broadband/cellular service provider on the Navajo Nation reservation (within the IHS Network), and it made clear the biggest challenge in high-poverty rural areas is the lack of a robust network for telehealth and telemedicine services.

While conducting interviews with facilities, several worthwhile observations were made regarding the prevalence, benefits,

challenges, and use of telehealth and telemedicine. Salient points from the interviews include these:

- Lack of access to technology and internet service are the key disrupters for telehealth.
- In response to the pandemic, telehealth was used more by larger systems in urban areas than by independent rural family practices, most likely due to the aforementioned lack of access to technology and internet service in rural areas.
- There is a clear digital divide; those who need telehealth the most have the least access (e.g., rural communities and older populations).
- Key provisions needed to support the use of telemedicine services include:
  - Access to electronic medical records and space for multiple screens
  - A quiet designated telemedicine room or area that is separate from staff or visitor spaces
  - Personal and digital privacy (Once a patient agrees to a telehealth visit via a Web platform, the patient's information becomes part of the metadata set.)
  - Video platform that supports clinical needs
  - More effective remote patient monitoring

Key drivers to expand provision of telemedicine services will be achieving payment parity and determining patient and provider liability. For example, if a patient using telemedicine services is asked to take and submit vital signs but does so incorrectly, the patient may inadvertently receive improper or harmful treatment. In such a case, is the provider liable for the patient's error? Decisions such as these will inevitably be played out in U.S. courts over the coming years, but their determination is crucial to the successful expansion of telemedicine services.

The interviews also revealed that reliance on technology for electronic appointments and preregistration via a smartphone

or device was problematic in isolated areas. Improved cell phone coverage is crucial to providing patient connectivity to the hospital and to the primary care physician responsible for directing the care plan. Following the discharge of a patient, this technology is also needed to schedule follow-up appointments.

Facility Constraints

The insights described here relate to challenges presented by limited resources and the issues caused by operating in aging facilities.

Flexible use space

The COVID-19 pandemic illuminated the importance of designing flexible spaces that can adapt to patient surge events and support delivery of the level of care needed during emergency conditions that result in higher patient acuity. Planning and considerations for flexible design include the following:

- Ability to convert patient rooms or other areas to address specialized patient needs (e.g., conversion to negative pressure to contain possible airborne contaminants or pathogens)
- Ability to temporarily convert patient rooms from single- to double-occupancy, as permitted by the AHJ
- Provision of additional mechanical, electrical, and plumbing services, including medical gas, to support temporary conversion of spaces (e.g., double-occupancy patient rooms or predetermined surge locations)
- Ability to separate patient populations (both physical separation and negative pressure) in units or areas of the hospital for infection isolation (e.g., a pod concept or similar room use grouping could create dedicated suites with control doors)
- How to accommodate new patient care functions by repurposing existing spaces[15]

During the interviews, one emergency management director noted the importance of having space that could be easily equipped and

converted into a negative pressure critical care room for the care of one or more COVID-19 positive patients. At this facility, the unused operating room and patient rooms located at the end of nursing units were temporarily equipped to serve as single- and double-patient critical care rooms. The existing HVAC system was modified to work with portable negative air units that were placed in the areas with COVID-19 positive patients.

Donning and doffing space

When rooms are designed to be flexible or repurposed and converted to an alternate use (e.g., a patient room that is converted to a critical care room), special care should be taken to accommodate the needs of the overall care environment. Specifically, the following should be provided to protect staff and patients:

- An anteroom, alcove, or other designated zone located immediately outside a room or suite of rooms converted to serve infectious patients
- PPE storage in the designated donning and doffing area
- Space for PPE disposal near the exit of the patient care room

Several interviewees indicated their facilities created areas with these features outside converted patient rooms to provide storage and fulfill donning and doffing needs. At one facility, lines of demarcation were placed on the floor outside entrances to converted critical care patient rooms to indicate additional storage and donning and doffing areas.

Distinct patient and staff flow patterns

Interviewees noted they established separate triage patterns for patients testing positive for COVID-19. The care plan implemented at one facility established patient handling protocol, flow, and direction based on the needs and condition of patients.

Clear flow patterns for staff and patients are always important, but the interview responses showed that during pandemic situations this need becomes critical. To ensure a clear flow pattern, a facility's

access points may need to be modified and/or secured and life safety features will need to be addressed when revisions are made to exit pathways.

Staffing accommodations

A common theme that emerged from the interviews was the pandemic's impact on staff health as staff members managed long shifts with extended stays and high patient mortality. Sufficient food provisions, showering facilities for staff who came into contact with infectious patients, and a place for staff to recharge were needed. In addition, these and other staff support spaces needed to be able to support more staff members than usual.

One facility's decision to place a hold on elective surgeries resulted in a vacant rehabilitation area. This space was modified to provide additional staff support resources such as a respite area and shower facilities in the locker room area. The provision of separate shower areas for staff providing treatment to infectious patients is recommended for future projects.

Additional Considerations

Discussed in this section are interview insights that do not apply to the specified themes above but should be considered as part of disaster response planning and preparation.

System associations, regional agreements, and coalition planning

When planning support services for a disaster or disruption, it is important to understand the distinction between small hospitals that are standalone entities and those that are part of a larger, integrated health care system. Small, unaffiliated hospitals and clinics are likely to be far more vulnerable, while system-affiliated facilities may benefit from a larger support system for supply chain logistics, clinical needs, and regulatory or reimbursement responses. For more information, refer to the Health Resources and Services Administration article[16] "Rural Communities and

Emergency Preparedness," which highlights the importance of coalition planning. Small facilities often are located in areas that are vulnerable to emergency situations. Therefore, it is necessary to have networks, associations, or agreements in place to effectively manage emergency situations to assure continuity of care.

These coalitions of partners (which may be independent of a health care system) have a specialized role in aligning common interests and considering specific regional needs when responding to a disaster. In North Texas, a smaller CAH that was part of a health care coalition took non-critical-care rehabilitation patients from a larger system "to free up capacity at the larger facility that was equipped to care for critical care patients." Through these kinds of regional associations, the following benefits may be realized:

- Collective procurement (e.g., faster, more secure procurement at reduced cost when supplies and equipment are ordered for multiple facilities)
- Patient transfer agreements (e.g., arrangements that support transfer of high-acuity patients to tertiary care facilities while low-acuity populations remain in smaller, rural facilities
- Shared staffing (e.g., cross-facility sharing of staff during surge events)

Incident command centers

Particular attention should be given to the development of an incident command structure with placement of an incident command center at each facility. A large teaching hospital system with a variety of facility sizes (including several CAHs) used both a hospital incident command system (HICS) and a systemwide incident command center. Based on their experience, the system recommends that hospitals:

- Use a HICS to coordinate individual facilities during systemwide disasters or pandemics.
- Have a central incident command hub (i.e., HICS) at an affiliated academic center and incident command centers at every hospital within their network.

- Plan space needs for the HICS and incident command centers based on the size of the facilities and their capabilities.
- Provide treatment in place, whenever possible.
- Operate command centers 24/7 during a crisis.
- Facilitate sharing of supplies and services across the system, as needed.

Small Facility Planning Recommendations for New Construction

Based on this subcommittee's studies, the following recommendations should be considered when planning a new small facility project:

- A panel of experts specializing in infection prevention and HICS planning should be assembled to review and analyze regional infection prevention practices and disaster response measures and make recommendations for physical environment features and operational steps to prepare the facility for future emergencies.
- The panel's recommendations should be based on the unique attributes of the facility, community, and region.
- The infection prevention and HICS panel should participate throughout the project design and construction process, including during commissioning of the completed facility.

Flexible Design Guidelines for Small Hospitals of All Types

Chapter 2.4 (Specific Requirements for Critical Access Hospitals) in the *Guidelines for Design and Construction of Hospitals* was written to align with regulations and qualification standards for reimbursement under the federal critical access hospital program. This chapter offers

many built-in features that allow and encourage a high level of flexibility not seen in the other FGI *Guidelines* hospital chapters. Indeed, this flexibility makes it the ideal chapter, as opposed to Chapter 2.2 (Specific Requirements for General Hospitals), for small hospitals that may not participate in the critical access program. Those managing or designing a CAH or other small hospital should use Chapter 2.4 and its detailed requirements in order to take full advantage of the flexibility provided by its planning and design requirements.

An Important Part of the U.S. Health Care System

Small and/or rural health care facilities are a critical link in the U.S. health care system. In addition to providing patient care, these facilities are often hubs for their communities. Community members may come to the cafeteria for meals, people may gather for public meetings or to meet socially, and in some locations these facilities provide the only reliable access to broadband wireless connection. Clinics, hospitals, and long-term care facilities are often the most valued places in the communities and regions they serve. A better understanding of their roles and challenges can inform emergency preparedness planning for future events.

Rural regions are disproportionately affected by weather-related disasters (which occur twice as often as 25 years ago) and emergency events such as the COVID-19 pandemic. The facility types discussed in this chapter can be found in inner cities, exurban areas and small towns and between towns. There are thousands of hospitals, outpatient clinics, and residential facilities across the country for which the suggested revisions noted in this chapter are intended. Given the increasing frequency of disasters nationwide, it is essential that the unique characteristics and circumstances of these facilities be considered when planning for emergencies.

While small and/or rural health care facilities face some challenges due to their size and geography, they also have strengths. For

example, many of these facilities have developed collaborative relationships in their communities that provide crucial support in times of need. Some of the most powerful solutions for improving the emergency response capability of these facilities have been found through such strengthened networks. Health care and community organizations with pooled resources can partner on long-term logistics planning and assist in development and implementation of a more robust and accessible digital communications system. The interviews conducted by this subcommittee found that the most resilient facilities had strong community and supplier networks that could be depended on for oversight and assistance.

Firsthand accounts of emergency-related challenges and site-specific solutions prove invaluable when assessing preparedness for future events. Additional interviews and surveys of staff and administration in small and/or rural health care facilities are suggested to gather more information. However, this subcommittee's intention is that the recommended change to the FGI *Guidelines* language shown here provide a solid base for discussion and revision of the *Guidelines for Design and Construction* in the years to come.

Resources

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Endnotes

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4 Cecil G. Sheps Center for Health Services Research, University of North Carolina, "Profitability of Rural and Urban Hospitals," PNG file, August 2016, https://www.shepscenter.unc.edu/wp-content/uploads/dlm_uploads/2016/08/Profitability-of-Rural-and-Urban-Hospitals-HD-1.png.

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14 This disrupter-based approach can also be used to identify inherent challenges in small and/or rural health care that lie beyond the scope of the *Guidelines*, yet strongly affect disaster response.

15 A "Flexible Room Use Tool" is currently in development by the FGI Rural Health Topic Group. When published, this tool will be available in FGI's Beyond Fundamentals library.

16 Office of Rural Health Policy, "Rural Communities and Emergency Preparedness."

Proposed Language Based on the 2018 Hospital *Guidelines*

The proposed new language below shows changes to the 2018 FGI *Guidelines* recommended by the small and/or rural health care facility design subcommittee of the Emergency Conditions Committee. Additions are underlined, and deletions indicated with a ~~strikethrough~~. Where an appendix item (i.e., a non-enforceable recommendation or guidance on applying a requirement) has been provided, an asterisk (*) precedes the section number (e.g., *1.2-4 Safety Risk Assessment). Appendix items can be identified by the letter "A" that precedes the correlating section number (e.g., A1.2-4 SRA). The text shown has been excerpted from the 2018 *Guidelines* and is not comprehensive. These proposed changes have been adapted and incorporated with recommended changes from other subcommittees in the draft *Guidelines for Emergency Conditions in Health and Residential Care Facilities* in the last section of this white paper.

***2.4-1.3 Site**

A2.4-1.3 Flexible site considerations for emergency events. The thoughtful provision of flexible open spaces that are strategically located on-site can support additional functional and programmatic requirements that may be required during emergency events. In order to maximize functionality, the flexible site must also factor in the appropriate systems infrastructure to support additional functions and programmatic requirements that may be needed in response to an emergency event. In isolated, remote, or rural locations and urban locations with limited outside resources, support, or connectivity, the following should be considered:

a. Identifying on-site locations that can be used for disaster preparedness, response, and recovery. These areas may include paved parking and roads, open canopy and garage structures, gravel laydown areas, mobile unit pads, future expansion areas, and loading docks.

b. Providing utility services to the identified locations for quick, convenient use when needed

*2.4-1.3.5 Hospital incident command system (HICS)

A2.4-1.3.5 Hospital incident command system. The facility should assemble a multidisciplinary management team to develop a hospital incident command system (HICS) to plan for surge events with a large influx of patients as a result of natural and man-made disasters and emergencies. It is recommended that the facility consider the following elements during the development of its HICS:

a. Site preparation for surge capacity

—Identify locations for temporary structures (including access to the site and staging areas).

—Evaluate need for additional utility services to accommodate temporary or transportable structures, mass casualty equipment, and/or expansion to designated areas outside the building.

—Consider parking overflow locations to handle increases in staff, patients, vendors, and visitors during an event.

—Determine need for event-specific storage for emergency equipment, medical supplies and equipment, portable trailers or mobile units, portable mechanical units (for temporary increase in positive and negative pressure rooms), and temporary partitions to accommodate altered patient flow.

b. Transportation accommodations

—Plan site accessibility to accommodate the increased number of delivery vehicles during a surge event.

—Identify docking and parking needs for daily and temporary supply vehicles.

—Identify ambulance and emergency vehicle (including helicopter and plane access) docking, parking, and housing needs.

c. Enhanced communications

—Consider provision of enhanced communication systems to facilitate communication among the incident command center, telecommunications, telemedicine services, staff communications, and state and local emergency management agencies.

—Identify the location of the incident command center; determine if location is permanent or ad hoc. Plan for adequate utility support services and safe storage of communications equipment when not in use. Consider proximity to toilet facilities, nourishment areas, and private offices and meeting rooms.

—Provide telemedicine spaces, equipment, and staff training to accommodate virtual visits and reduce the number of patients on site during crisis events. Ensure the system has the ability to operate uninterrupted in emergency mode.

—Make provisions for a reliable, safe and secure telecommunications support system with the ability to operate uninterrupted in emergency mode should the need arise.

—Ensure ability of communications systems to handle additional needs during an emergency including

telemedicine and work-at-home support systems for non-frontline staff.

d. Access points control and security

—Develop a facility safety and security strategy to control unrestricted access and protect and preserve assets during a crisis.

—Identify access points in the facility for potentially infectious patients (e.g., ED and ambulance entrances) and non-infectious patients (e.g., main entrance and selected entrances for specialty services).

—Identify potential locations of security stations for personnel to monitor and allow access into the facility. Provide a secure location with adequate communication resources to initiate alarms.

—Develop emergency wayfinding plans. Successful wayfinding planning will address alternate use of spaces and campus facilities necessitated by an emergency condition. Signage and electronic wayfinding methodologies should be simple, easy to understand, and capable of adapting to changes in function.

e. Staff services

—Consider the impacts of expanded staff services during a crisis. Plan to accommodate staff needs during prolonged shifts of 12 hours or more during crises.

—Provide an adequate number of accessible locker rooms for staff to secure their belongings and change attire. Ensure availability of accessible lockers for all essential personnel including doctors, nurses, maintenance staff, environmental services staff, pharmacists, laboratorians, technicians, etc.

—Evaluate areas in the facility and/or nearby lodging to accommodate overnight stays for staff and their families.

***2.4-2.2.8.13 Equipment and supply storage.** Equipment and supply storage shall be provided. For requirements, see Section 2.1-2.8.13 (Equipment and Supply Storage).

A2.4-2.2.8.13 Equipment and supply storage considerations for emergency events. An emergency event could disrupt the supply chain for items that are necessary to support a surge event, including the provision of patient care services. In isolated, remote, or rural locations and urban locations with limited outside resources, support, or connectivity, consider supplemental storage spaces—on-site or off-site if easily accessible—to accommodate specialized needs prior to, during, and after a disaster event. Additional storage may be needed for items such as medical equipment (e.g., ventilators), medical gas cylinders, PPE, food, medical supplies, and generator diesel fuel.

***2.4-3.2.2 Additional Emergency Services Requirements**

A2.4-3.2.2 Space considerations. When performing a DEVA, health care facilities should identify available flexible space in the facility. Space considerations include:

a. Layout and clearances to accommodate one-way flow patterns

b. Segregation of patient populations during and after an emergency event

c. Potential adaptability of rooms or spaces to alternate functions during an emergency event (e.g., planning a patient room so that it could function as a negative pressure room)

***2.4-8 Building Systems**

A2.4-8 See appendix section A2.4-1.3 (Flexible site considerations for emergency events) for building systems considerations for flexible site use during an emergency condition.

***2.4-8.5.2 Telecommunications and Information Systems**

A2.4-8.5.2 Telecommunications and information systems considerations for disaster events

a. Consideration should be given to location, access, availability, and placement of telecommunication and broadband access points (hard-wired and WiFi) to support flexibility prior to, during, and after a disaster event. Strategically locating telecommunication and broadband access points can support additional functional and programmatic requirements during an emergency event.

b. Surge locations identified during planning should have access to telecommunication and broadband access points to properly function as an extension of the facility and connect to outside support services.

c. See appendix section A2.4-1.3 (Flexible site considerations for emergency events) for parking and site planning considerations.

Proposed Language Based on the 2018 Outpatient *Guidelines*

***1.3-1 General**

A1.3-1 Flexible site considerations for emergency events. The thoughtful provision of flexible open spaces that are strategically located on-site can support additional functional and programmatic requirements that may be required during emergency events. In order to maximize functionality, the flexible site must also factor in the appropriate systems infrastructure to support additional functions and programmatic requirements that may be needed in response to an emergency event. In isolated, remote, or rural locations and urban locations with limited outside resources support, and connectivity, the following should be considered:

a. Identification of on-site locations that can be used for disaster preparedness, response, and recovery. These areas may include paved parking and roads, open canopy and garage structures, gravel laydown areas, mobile unit pads, future expansion areas, and loading docks.

b. Provision of utility services to the identified locations for quick, convenient use when needed

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***2.1-5.4.3 Equipment and Supply Storage**

A storage room(s) for building maintenance supplies and equipment shall be provided.

A2.1-5.4.3 Equipment and supply storage considerations for emergency events. An emergency event could disrupt the supply chain for items that are necessary to support a

surge event, including the provision of patient care services. In isolated, remote, or rural locations and urban locations with limited outside resources, support, or connectivity, consider supplemental storage spaces—on-site or off-site if easily accessible—to accommodate specialized needs prior to, during, and after a disaster event. Additional storage may be needed for items such as medical equipment (e.g., ventilators), medical gas cylinders, PPE, food, medical supplies, and generator diesel fuel.

*** 2.1-8.5.2 Telecommunications and Information Systems**

The requirements in this section shall be applied to outpatient facilities in freestanding buildings or a portion of a building with a separate occupancy classification.

A2.1-8.5.2 Telecommunications and information system recommendations ~~requirements~~

a. Provision of these spaces should be considered for outpatient facilities located in a suite in a multi-tenant building (e.g., medical office buildings, outpatient surgery facilities, emergency facilities outside a hospital).

b. Considerations for disaster events

—Consideration should be given to location, access, availability, and placement of telecommunication and broadband access points (hard-wired and WiFi) to support flexibility prior to, during, and after a disaster event. Strategically locating telecommunication and broadband access points can support additional functional and programmatic requirements during an emergency event.

— Surge locations identified during planning should have access to telecommunication and broadband

access points to properly function as an extension of the facility and connect to outside support services.

—See appendix section A1.3-1 (Flexible site considerations for emergency events) for site planning considerations.

Proposed Language Based on the 2018 Residential *Guidelines*

***1.3-1 General**

A1.3-1 Flexible site considerations for emergency events. The thoughtful provision of flexible open spaces that are strategically located on-site can support additional functional and programmatic requirements that may be required during emergency events. In order to maximize functionality, the flexible site must also factor in the appropriate systems infrastructure to support additional functions and programmatic requirements that may be needed in response to an emergency event. In isolated, remote, or rural locations and urban locations with limited outside resources support, and connectivity, the following should be considered:

a. Identification of on-site locations that can be used for disaster preparedness, response, and recovery. These areas may include paved parking and roads, open canopy and garage structures, gravel laydown areas, mobile unit pads, future expansion areas, and loading docks.

b. Provision of utility services to the identified locations for quick, convenient use when needed

***2.3-4.2.4.1 Storage for equipment and supplies for care and services.** Storage space(s) for equipment and supplies used by staff for resident, participant, and outpatient care and services shall be immediately accessible to the areas when they are used.

A2.3-4.2.4.1 Equipment and supply storage

a. Equipment and supply storage items

—Equipment may include portable lifts, movable commodes, shower chairs, and carts

—Supplies may include linens, disposable products, slings, accessories for lifts such as battery chargers, dressings, office supplies, etc.

b. Equipment and supply storage considerations for emergency events. An emergency event could disrupt the supply chain for items that are necessary to support a surge event, including the provision of patient care services. In isolated, remote, or rural locations and urban locations with limited outside resources, support, or connectivity, consider supplemental storage spaces—on-site or off-site if easily accessible—to accommodate specialized needs prior to, during, and after a disaster event. Additional storage may be needed for items such as medical equipment (e.g., ventilators), medical gas cylinders, PPE, food, medical supplies, and generator diesel fuel.

(1) Sufficient storage space(s) shall be provided to keep required corridor width free of equipment and supplies.

(2) Cabinets, closets, rooms, and alcoves shall be permitted to provide storage.

*2.5-5.1.1 Application

Requirements for call systems, information systems, and telecommunication systems shall be based on the care population and provided in accordance with requirements in the facility chapters in Parts 3 through 5.

A2.5-5.1.1 Communications systems considerations for emergency events

a. Consideration should be given to location, access, availability, and placement of telecommunication and broadband access points (hard-wired and WiFi) to support flexibility prior to, during, and after a disaster event. Strategically locating telecommunication and broadband access points can support additional functional and programmatic requirements during an emergency event.

b. Surge locations identified during planning should have access to telecommunication and broadband access points to properly function as an extension of the facility and connect to outside support services.

c. See appendix section A1.3-1 (Flexible site considerations for emergency events) for site planning considerations.

Chapter 7: Emergency Preparedness in Residential Settings

The realities of coronavirus disease 2019 (COVID-19) reminded us how design shapes our experiences and either creates opportunities or presents challenges in different situations. As senior living communities and care providers responded to the mandates and guidelines from the Centers for Medicare & Medicaid Services (CMS) and health departments, many were challenged to adapt their environments to respond to the pandemic. Architects and designers grappled with how to assist owners and how to improve designs currently in development to better prepare for the future.

Recognizing the opportunity to capture these processes and outcomes in real time, the FGI Emergency Conditions residential subcommittee of researchers, architects, senior living community representatives and care providers, and authorities having jurisdiction (AHJs) sought to collect case studies and evidence-based information, identify solutions, craft recommendations, and establish minimum standards to address a pandemic as well as a wide variety of other emergency conditions, including weather-related emergencies, natural disasters, and hostile trespass.

The residential subcommittee recognized that the breadth of the facility types and user groups in the FGI Residential *Guidelines* requires equally varied responses in emergency situations. For example, independent living settings are intended for residents who are capable of self-preservation, and so emergency responses for this building type are more likely to be operational than architectural. On the other hand, in settings for older adults who are reliant on others in the event of an emergency, the physical environment is a significant factor in safety, operational practices, and service preservation. For this reason, the group's recommendations for residential environments are primarily focused on nursing homes, hospice facilities, and assisted living settings, but not at the exclusion of other settings where a proposed intervention or *Guidelines* change would apply.

Residential Subcommittee Framework for Making Recommendations

The facility design requirements and recommendations in the Residential *Guidelines* are intended to foster development of person-centered living environments that support quality of life of residents in a variety of care models. Design standards are provided for a wide array of settings, including nursing homes, hospice facilities, assisted living facilities, independent living facilities, settings for individuals with intellectual and/or developmental disabilities, adult day care facilities, wellness centers, outpatient rehabilitation facilities, and substance abuse treatment facilities. The publication of the Residential *Guidelines* in 2014 as a document separate from the Hospital and Outpatient *Guidelines* documents distinguished the settings included in the Residential *Guidelines*—which primarily serve elderly or special needs populations and are often the person's actual residence—from environments an individual experiences for a shorter time (e.g., a hospital patient room). In addition, this distinction supported the creation of environments for elders and special needs residents that address the environmental safety considerations specific to these populations, which exceed requirements for inpatient or outpatient facilities.

The requirement for a resident safety risk assessment (RSRA) has been present in the Residential *Guidelines* from its inception. Components included in the RSRA are assessments of infection control risk, resident mobility and transfer risk, resident fall risk and prevention, resident dementia and mental health risk, medication error risk, security risk, and disaster risk and emergency preparedness. In the 2018 Residential *Guidelines*, appendix section A1.2-3.8 (Disaster Risk and Emergency Preparedness) states, "Residential health, care, and support facilities generally are expected to be functional, safe, and secure for residents, family members, visitors, and staff while remaining prepared for natural and man-made emergencies 24 hours a day/7 days a week." Accordingly, Section 1.2-3.8.2.1 (Disaster risk and emergency preparedness: Compliance elements) requires that, "In locations with recognized potential for hurricanes, tornadoes, flooding, earthquakes, or other regional disasters, the need to protect the life safety of all residential health, care and support facility occupants and the potential need for continuing services following such a disaster shall be considered during project planning and design."

As well, a disaster preparedness or emergency operations plan should be prepared for new construction and renovation projects to respond to risks identified in the disaster risk and emergency preparedness assessment, renamed the disaster, emergency, and vulnerability assessment (DEVA) by the risk assessment subcommittee of the FGI Emergency Conditions Committee (see Chapter 1 in this document for more information). The emergency operations plan should include recommendations from a multidisciplinary team to address resident placement and relocation, standards for barriers and other protection measures required to safeguard areas of refuge from identified potential disasters, and infection control risk mitigation strategies.

Areas of concern in planning for emergency conditions include design for continued operations (power, water, medical, and—in some locations—HVAC systems), wind- and earthquake-resistant design considerations, and protection against flooding. Where minimum requirements and recommendations for emergency planning already exist, they are favored in lieu of creating new and potentially conflicting language in the Residential *Guidelines*.

Disasters and Their Potential Impact on Residential Settings

Because supporting the quality of life of residents in a variety of care models is the focus of the Residential *Guidelines*, any new recommendations for emergency conditions should also be considered through this lens. In May 2020, Planetree published "Person-Centered Guidelines for Preserving Family Presence in Challenging Times,"[1] a white paper developed in response to

Figure 7-1: Residential Subcommittee Matrix Overview

Emergency Situation	Type(s) of Threats	Risks	Threats to Physical Structure/ Campus	Typical Duration of the Immediate Threat	External Stakeholders involved in response	Access to building restricted during threat?	Evacuation or Protect-in-Place	Considerations for Building & Systems
Weather/ Tectonic	Tornadoes, hurricanes, storms, extreme temperatures, earthquakes	High winds, excessive water and/ or flooding, Ice, life-threatening temperatures (cold or hot), falling objects	Failure and/or compromised building enclosure, structural damage, loss of utility services, impeded access to property if roads become blocked	"Hours/Day/ Days *dealing with the aftermath may stretch into weeks."	Utility company personnel, possibly fire department if responding to utility that may result in fire risk, contractors	Not likely Family and community can still come in and be connected with residents and staff. Family presence may be instrumental in support and relieve. Caregiver burden	Most commonly protect-in-place unless hurricane evacuation orders are issued.	Anticipating interruptions in water supply and other utilities such as electrical, HVAC, telecommunications, structural redundancy in building design
Wildfire	Uncontrolled burning	Excessive heat, smoke	Failure and/or compromised building enclosure, structural damage, loss of utility services, impeded access to property if roads become blocked	"Hours/Day/ Days/ Weeks *dealing with the aftermath may stretch into weeks."	Utility company Personnel, fire department, contractors	Not likely Family and community can still come in and be connected with residents and staff. Family presence may be instrumental in support and relieve Caregiver Burden	If building is in the path of fire, and/or air quality is life threatening, evacuation may be required.	Protecting building and property from destruction due to fire, anticipating loss of utility services
Pandemic	Contagions	Uncontrolled spread of pathogens that result life-threatening illness	No real threats to the physical structure of the building or campus	Weeks/ Months/Year	Local/State/ National Health Departments	Yes Restricted access	Protect in Place	HVAC systems and indoor air quality become more critical/ scale and spatial referents become more critical to manage distances between individuals.
Hostile Threats or Trespass: Active Shooter/ Search for Violent Offender/Civil Unrest	Individual(s) with a weapon intent on harm	Injury or death to residents/ staff/ visitors	Failure and/or compromised building enclosure.	Hours/Day/ Days	Law enforcement	Yes Restricted access	Protect in place	Surveillance systems, communication technology. Management of entrances and exits; considerations for views and visual access.

Figure 7-1: Residential Subcommittee Matrix Overview *(continued)*

Emergency Situation	Themes for Areas of Design Intention				
	Caregiver Burden	Meaningful Engagement	Social Connectedness	Continuity of Care	Infection Control
Weather/ Tectonic	Temporary disruption	Temporary disruption	Temporary disruption	Duration of Disruption depends on the duration of the impact on the building systems	Duration of Disruption depends on the duration of the impact on the building systems and potential loss of water/ electrical/ HVAC
Wildfire	Temporary disruption	Temporary disruption	Temporary disruption	Duration of Disruption depends on the duration of the impact on the building systems	Duration of Disruption depends on the duration of the impact on the building systems and potential loss of water/ electrical/ HVAC
Pandemic	Major consideration	Major consideration	Major consideration	Duration of Disruption depends on operational responses to managing people and spatial distances. Existing building design and layout become a critical issue	Major consideration
Hostile Threats or Trespass: Active Shooter/Search for Violent Offender/ Civil Unrest	Temporary disruption	Temporary disruption	Temporary disruption	Temporary disruption	No disruption

the early stages of the COVID-19 pandemic. The purpose of this document was to create guidelines that support person-centered care while balancing resident socio-emotional needs with clinical safety needs as well as the needs of individuals with the needs of the community. Planetree's document resonated with members of the residential subcommittee, who then identified a series of themes important to consider in emergency situations. These themes are meaningful engagement, social connectedness, continuity of care, infection control, and caregiver burden.

The residential subcommittee determined that existing disaster risk and emergency preparedness text in the Residential *Guidelines* needed review and augmentation based on these themes. The most challenging aspect of the task was the need to balance the many operational changes that may be implemented during an emergency

event with recommendations specific to the design of the building. To better evaluate the *Guidelines* text, a matrix was developed to focus new recommendations on environmental responses to emergency conditions while keeping the themes and operational considerations in mind.

The matrix includes five main emergency conditions: weather/tectonic, wildfire, utility grid outages, pandemic, and other hostile threats (e.g., active shooter, riot, terrorism, violent offender search situations). For each emergency event, the following were considered:

- Threat types
- Characteristics or risks of identified threat types
- Specific threats requiring a design response (to prevent or recover from the threat)
- Duration of the threat (hours, days, or longer-term duration)
- External stakeholders involved in the emergency response
- Building access
- Strategies for evacuation or protect-in-place
- Building and systems considerations

After these considerations were explored, a level of disruption was identified for each theme and each type of emergency condition. The subcommittee found this matrix tool valuable in identifying what recommendations were missing from the existing Residential *Guidelines* document and guiding the subcommittee to topics needing new environmental guidance.

The matrix quickly revealed that "pandemic" was the emergency condition with the least guidance in the existing Residential *Guidelines*. While basic language is provided for water, plumbing, and heating, ventilation, and air-conditioning (HVAC) systems in Section 1.2-3.2 (Infection Control Risk), the language is focused on recommendations and requirements for airborne infection isolation rooms in nursing homes and infection control risk mitigation recommendations during construction. Given the profound impact

of COVID-19 on residential care environments in 2020, the residential subcommittee focused their attention on reviewing research and case studies to inform their recommendations for a pandemic. This was the primary focus of the subcommittee's work. Recommendations for maintaining power supply and preparing for hostile threat and trespass incidents supplement the guidance.

Lessons Learned

The subcommittee evaluated existing white papers, articles, and research on emergency conditions. Feedback also was solicited from for-profit and non-profit providers and members of LeadingAge and the American Health Care Association/National Center for Assisted Living (AHCA/NCAL) to gain an understanding of the real-time challenges that providers face during emergencies. Specifically, input was solicited on how a provider's existing environment helped or hindered their response to the emergency and what changes to the built environment, if any, were being considered to alleviate challenges in future emergency situations. Recommendations based on these interviews, research, and case studies follow.

Building Scale and Density

Building scale and density relate to the composition of and balance between the physical space and the number of occupants who use an environment on a regular basis. The Residential *Guidelines* addresses the impact of these factors on housing configurations and service provisions for older adults in nursing homes, assisted living communities, and hospice environments by determining proximities and access to centralized or decentralized resources for different user groups.

Historically, nursing home environments have been densely packed with residents who have various co-morbidities and share limited common areas located in central locations, some of which may be remote from some users.[2] Although newer models, such as household designs, have started to evolve away from these more

institutional layouts, numerous new projects still default to massing groups of people to support operational practices that permit minimal staff coverage, long considered efficient for caring for large numbers of residents. The recent pandemic, however, has revealed the "not-so-hidden" cost of these institutional-based design and service models.[3] A recent study from Canada found that "COVID-19 infections in nursing homes were extremely concentrated, with almost 90 percent of the infections occurring in 10 percent of all homes," and those homes were the ones that had the highest density.[4]

Homes that had the capacity to segment, or those that were already designed around a household model, attributed their ability to reduce or eliminate infections to this specific design factor.

Homes that were most successful in keeping infection rates low deployed a strategic plan of restricting outsiders, screening visitors and staff, adhering to protocols for personal protective equipment (PPE), dedicating staff to specific areas of the building and to specific residents, and making needed staff resources available in the immediate work areas.[5] While these strategies were largely operational, building layout and scale played a critical role in reducing or preventing the need for staff to travel around the larger building and pass through unrelated resident areas and staff workspaces.

Smaller intentional environments for aging residents supported by staff in a decentralized manner offer a strong defense against infection transmission. Designing for smaller cohorts of residents also directly affects resident well-being through familiarity from consistent staffing, frequent connections between those in the cohort, and autonomy over where each resident spends the day; as well, the smaller groups allow staff to leverage the normalcy provided by such an environment to reduce resident anxiety and fear. When members of a community are interconnected and interdependent, and receiving optimum care, their lives are more vibrant.

During the pandemic, administrators operating buildings with such household environments serving fewer than 20 residents reported a very low incidence of infection, which they attributed to the household arrangement that had everything residents and

staff needed and their existing practice of having dedicated staff serve a dedicated group of residents. Thus, when there was a case, containment was manageable. Homes that had the capacity to segment residents and services, or those that were already designed around a household model, attributed their ability to reduce or eliminate infections to this specific design factor.

While evidence may be anecdotal at the time of this writing, providers who shared their experiences were adamant in their support of building design that allows small group segmentation and positions resident and staff resources in easily accessible locations.

These providers also pointed out that deployment of ancillary staff to support the functioning of smaller environments was helpful during the pandemic. Therapists, dietary/kitchen staff, environmental services/laundry staff, and staff from other departments that were not being utilized in their normal role assisted with family connections, meaningful engagements, fitness sessions, making of beds, dusting, residents' personal laundry, and so on. The key to success was assigning staff consistently to specific homes or areas to maintain the connectedness of small, household-like environments.

Household Model

In appendix section A3.1-2.2.1.3 (3) (Connected and freestanding household model units and staffing considerations) in the Residential *Guidelines*, household units are defined as "resident-centered care models that change the philosophy of care to create a household-scale environment. The goal is to create a small community of residents in a home that is supported by staff members specifically trained in this philosophy of care."

Initial research on how the household model has fared during the COVID-19 pandemic is promising. Researchers at the University of North Carolina at Greensboro are tracking infection rates and resulting COVID-19 deaths in Green House Project homes and similar small house models that serve both skilled care and assisted living populations. Preliminary findings from February 1, 2020 – May 31, 2020, demonstrate that COVID-19 deaths reported from

national nursing home data were 27.5 deaths per 1,000 nursing home residents, while Green House settings had a rate of .42 per 1,000 nursing home residents. Follow-up data reported in July 2020 revealed that 95.5 percent of Green House homes and small houses were COVID-free and 87.5 percent of assisted living settings were COVID-free. Reduced scale and low density are hallmarks of the Green House Project and small house models.[6]

Further, the Green House Project found that the small scale and established dedicated staffing of Green House and small house models allowed these facilities to keep operating as normal during the pandemic, keeping disruption to their residents to a minimum.

Neighborhood (Cluster) Model

Appendix section A3.1-2.2.1.3 (2) (Cluster and/or neighborhood model and staffing considerations) in the 2018 Residential *Guidelines* defines neighborhoods (or clustering) as a "decentralization strategy used to improve aesthetics, streamline service, shorten travel distances, and simplify handling of linen. It also permits more localized social areas and optional decentralized staff work areas." This can be accomplished by various approaches, such as creating designated staff work areas that focus on lower densities of people who live together in an identifiable zone and are cared for by a designated team of staff. As previously noted, surveys and interviews with multiple providers demonstrated that these smaller scale designs within larger buildings were especially helpful in managing the challenges of the COVID-19 pandemic. This approach is also supported by the intent of CMS guidance issued in April 2020 to have dedicated work teams for groups of residents.[7]

"[W]e observed a protective effect of larger homes with more active residents on the extent of COVID-19 outbreaks and resident deaths, something we suspect is related to homes with new design standards having self-contained 'resident home areas' that accommodate no more than 40 residents."

—"Association Between Nursing Home Crowding and COVID-19 Infection and Mortality in Ontario, Canada," *JAMA Internal Medicine* (November 9, 2020)

There are benefits to an approach that reduces the number of staff working across designated

areas and capitalizes on versatile workers who are cross-trained in areas of care and service. To be prepared to effectively contain infectious disease outbreaks, during the functional programming process the care organization must assess how the neighborhood (or cluster) is positioned within the larger long-term care environment

Figure 7-2: COVID-19 Unit Conversion at Redeemer Health and Rehab Center, Minneapolis

At Redeemer Health and Rehab Center in Minneapolis, a portion of the existing first floor was converted to a COVID-19 unit by adding doors to create a vestibule that separated it from the rest of the building and identifying a separate rear entry point for staff dedicated to the unit.

Source: Pope Architects

as well as how the organizational design (e.g., dedicated staff vs. floating staff) and operational practices (e.g., management of medication distribution, food, laundry, and custodial services) limit the number of staff who move in and out of the household or designated staff work area.

Administrators and staff whose facilities were neither stand-alone nor comprised of fully independent households provided the residential subcommittee with examples of how they were able to segment their staff work areas within existing traditional buildings (e.g., using fire/smoke doors as barriers). This strategy was an effective physical environment response for mandated operational practices to dedicate specific areas for relocation and care of infected residents.

Based on the experiences of providers across the country, the residential subcommittee offers the following recommendations for building design and layout in new construction.

As discussed earlier, initial research demonstrates that the operational and physical construct of the household model has made it successful in limiting the incidence of COVID-19. While more research is forthcoming, early results show that the household model should be considered by operators or developers constructing new nursing homes or hospice facilities.

Likewise, larger settings should be designed to provide basic support services around small groupings of resident rooms. A number of providers who used household models or clearly designated staff work areas reported that neighborhoods/clusters of 16 to 20 rooms allow for better infection prevention.[8] For each neighborhood/cluster, it is also helpful to plan a four- to six-bedroom containment area for use during an infectious disease outbreak. This could be accomplished by using temporary walls if a permanent separation doesn't already exist. Each containment area should include an entrance vestibule to accommodate PPE storage and disposal and space for staff to don and doff PPE. The containment area should have enough space for staff to access the following support areas without leaving the containment area: staff work area, equipment and supply storage, clean utility room, soiled workroom, and a

medication room. Such a physical environment response would both provide and limit access into a positive infection containment area, thereby reducing the risk of infection for other residents and staff.

It may not be enough to restrict travel to/from a positive infection containment area during a pandemic. Providers and designers should consider circulation patterns early in the functional programming and RSRA stages of project planning and document any potential temporary shifts in travel required by their emergency plans. Section 3.1-2.2.1.2 (Resident unit: Layout) in the 2018 Residential *Guidelines* has a requirement to this effect for nursing homes; however, because of provider feedback on the COVID-19 pandemic, the residential subcommittee felt that language should be strengthened to require the design of new hospice and nursing home environments to minimize unrelated travel through resident neighborhoods, clusters, and households. One key consideration should be staff work areas and how they can be arranged to reduce unrelated travel through areas.

Entrances, Lobbies, Vestibules, and Wayfinding

When planning the location and number of entrances for a new facility, providers and designers should consider how access and circulation may need to be directed during an emergency event. For example, a building entrance may need to be dedicated to use by specific staff members during a pandemic. The MASS Design Group paper on "Designing Senior Housing for Safe Interaction" states, "Strong wayfinding will help visitors and service providers navigate semi-public and semi-private spaces and limit unnecessary mixing. A clear threshold of sanitary protocols for both people and goods will additionally reinforce the inside of the building as a clean zone."[9] Descriptive signage should be posted on the interior and exterior of vestibule doors with special instructions for entry and exit during pandemics and other emergency events that require restricted access. Instructions should be provided in all languages commonly found in the resident, staff, and community population.

Where possible, staff should have a dedicated building entrance and exit that is physically separate from that for residents, visitors, and other services. During a pandemic, space should be designated for a screening area upon entry into the building by either visitors or staff per recommendations of the Centers for Disease Control and Prevention (CDC).

Where buildings have multiple elevators, providers should consider designating one elevator for the exclusive use of staff and service and investigating the use of elevator functions such as destination dispatching, where a key card or fob is used to reduce or eliminate the use of elevator call and control buttons. Operationally, facilities should limit the number of people who may occupy an elevator at one time during a pandemic to allow for physical distancing, provide hand sanitation dispensers in elevator lobbies, and increase the cleaning frequency of elevators and call stations.

Room Design

The current norm in residential health care settings is double-occupancy rooms. Most residents share bedrooms, bathrooms, activity rooms, and dining rooms. This arrangement, which has been in place for decades, was instituted partly to lower costs but also to encourage socializing. However, shared resident rooms also create privacy concerns, resident compatibility issues, and—during flu season or in the case of the COVID-19 pandemic—problems with infection prevention and control. The residential subcommittee believes it is time to settle the argument for private rooms in residential health care settings.

Private Rooms in Nursing Homes

There are many reasons private rooms should become the norm in residential settings. The arguments used a decade ago when proposing private rooms in hospitals apply equally, if not more so, to residential settings. A 2007 article[10] by Margaret Calkins and Christine Cassella made a strong case for private resident

rooms. From a psychosocial perspective, people express a deep preference for private rooms because they provide greater privacy and personal control. Residents do not want to share a room with a stranger, someone they have never met and with whom they may have nothing in common. There are also clinical reasons supporting provision of private rooms, including prevention of nosocomial infection, which is the deficiency most frequently cited by health inspectors.[11] Annually, more than a million nursing home residents contract infections, and as many as 388,000 eventually die from them.[12] Numerous pre-COVID studies demonstrate that private rooms reduce a resident's risk of developing nosocomial infection.

On a related note, it has been shown that in emergency situations (e.g., pandemic, seasonal flu outbreak), the ability to isolate residents is vitally important. The use of single-occupant rooms allows for quick and effective isolation to protect against the spread of viruses and other infections. NCAL/AHCA and other providers interviewed credited private rooms as a prime factor in their ability to contain the spread of COVID-19 in their communities. Many providers with facilities that currently provide shared rooms said they planned to use only private rooms in future new construction.

Daniel Ruth, CEO and president of the San Francisco Campus for Jewish Living, stated, "I absolutely believe that all rooms should be single rooms." Accordingly, almost all rooms are single-occupant at the Jewish Home, the nursing facility on the campus. The campus houses more than 300 elderly residents, yet it experienced very low rates of COVID-19 during the first six months of the pandemic. Similarly, in Green House homes, which have all private rooms, 95.1 percent of houses surveyed (n=229) were COVID-free, and there was only one COVID-19-related death, through July 2020. The final report of the Coronavirus Commission for Safety and Quality in Nursing Homes[13] also states that private rooms help protect residents from infection and recommends "changes to the CMS reimbursement [policy] that would promote single occupancy (temporarily during pandemics as well as in the long term)."

Two recent studies from Canada provide solid evidence that communities with a high percentage of private rooms had

significantly lower rates of COVID-19 and fewer deaths.[14] Using data from 623 homes in Ontario accommodating 78,607 residents, this study rated each home on a crowding index, which ranged from 1.3 (mostly private rooms) to 4.0 (exclusively quadruple occupancy rooms). Fifty percent of the homes had a high crowding index (greater than 2) while 50 percent had a low crowding index. They found that "incidence in high crowding index homes was 9.7 percent, versus 4.5 percent in low crowding index homes ($p<0.001$), while COVID-19 mortality was 2.7 percent, versus 1.3 percent." This means people were more than twice as likely to contract COVID-19 when the crowding index was high (a greater percentage of two- and four-person rooms).

In an article in the *Canadian Medical Association Journal* published in July 2020, the authors[15] found that buildings designed and built according to older standards (allowing four-person rooms with no limitations on the size of resident units) were associated with significantly higher rates of infection per thousand residents (adjusted RR 1.88, 95 percent crowding index) when compared to homes designed and built to newer standards (limiting occupancy to two-person rooms and 32 residents per unit).

Clinical benefits of single-occupant rooms include decreased resident anxiety, fewer incidents of aggressive behavior, lower risk of medication errors, and improved resident sleep patterns. Single-occupant rooms also yield operational benefits such as an overall increase in staff effectiveness. For example, staff have reported they spend significantly more time managing resident-to-resident disagreements when residents are placed in shared rooms. Accordingly, single-occupant rooms improve staff satisfaction and reduce burnout.

Finally, the article by Calkins and Cassella finds that the additive costs of constructing two private rooms (each with their own private bathroom) compared to one semi-private room (with a shared bathroom) breaks down to a few dollars a day (in 2007 dollars) over the life of a 30-year mortgage, which can be recouped fairly easily.

Although private rooms should become the industry norm, there are and will continue to be circumstances where a shared room is

Figure 7-3: Sample Companion Room Layout

Source: Bethany of the Northwest/Cleary O'Farrell Photography and Shoesmith Cox Architects

warranted and, with proper justification, should be allowed. In some instances, a couple or siblings who become residents of the same facility may wish to room together; in these cases, companion rooms should be provided. Companion rooms are designed for the purpose of room sharing and consideration should be given to a layout that allows for flexibility so that either each person can have their own space or half the room could be used as a sitting area while the other half accommodates both beds (or one larger bed). An alternative way to provide companion rooms is to design a wall section between two rooms that can be easily removed to allow residents to share space when desired.

Private Rooms in Assisted Living Facilities and Residential Substance Abuse Treatment Facilities

Assisted living facilities that provide long-term care for resident populations similar to those in nursing homes and long-term residential substance abuse treatment facilities—although dealing with a very different age demographic—each face issues similar to those in nursing homes. They, too, must consider privacy, incompatibility of roommates, resident anxiety, medication errors,

incidents of aggressive behavior, and nosocomial infections. For these reasons, private rooms should be the norm in these facility types as well, with allowances for circumstances where a shared room is warranted. As in nursing homes, assisted living communities may have couples or siblings who want to live together in one room. In long-term residential substance abuse treatment facilities, there may be clinical reasons for room-sharing. In both these cases, it is essential to address this need in the functional program and shared rooms should be allowed after a review by the AHJ.

Private Rooms in Hospice Facilities

The same issues that are present in nursing homes and assisted living regarding privacy, incompatibility of roommates, resident anxiety, medication errors, and nosocomial infections are also shared by hospice facilities. But in these facilities, privacy becomes paramount.

At the end of life, families often want to spend significant amounts of time with their loved one, to celebrate their life and to grieve. This process should not have to be witnessed and shared by an unrelated individual (roommate) and that individual's visitors. This is the single greatest argument for single, private rooms in a hospice setting. As with the other residential settings previously discussed, room size and capacity should include consideration for accommodating couples who may be receiving hospice care individually or concurrently.

Operable Windows

Operable windows can be an effective tool for creating healthy spaces and should be considered by providers. They allow for direct fresh air exchange and, depending on the window design, may enable the facility to temporarily connect equipment that can enable a standard resident room to function as a negative pressure room. This is especially important during an infectious disease outbreak (e.g., COVID-19 or influenza). In February 2020, the Chinese government issued new guidelines for preventing and controlling COVID-19 in senior living facilities. This guidance recommended

the provision of operable windows and advised opening the windows for at least 30 minutes every 12 hours with mechanical ventilation (a fan), where appropriate (based on weather or other external conditions).

While the use of operable windows in residential health, care, and support facilities should certainly be considered, the residential subcommittee felt that requiring operable windows in new facilities was too big of an expectation as a minimum standard because these windows could have negative impacts on buildings with complex HVAC systems. Therefore, the subcommittee recommends consideration of operable windows as part of the RSRA.

Hand Hygiene

To ensure proper hand hygiene, there must be enough fixtures (e.g., sinks and hand sanitation dispensers) to support efficient and effective patterns for use.

Hand Sanitation Dispensers

Touchless alcohol-based hand sanitation dispensers are easy to install, convenient to locate, discreet in appearance, simple and quick for staff to use, and available in wearable dispensers. Research has shown the effectiveness of alcohol-based dispensers, but not at the exclusion of traditional soap-and-water hand-washing, which are still essential for certain hand hygiene tasks, especially when hands are visibly soiled.[16]

Hand-Washing Stations

While studies suggest that electronic sensor-regulated faucets may contribute to pathogen transmission, research indicates the main contributing factors for this infection risk are the provision of aerators, use of polyvinylchloride instead of copper fittings, low water flow, and lack of temperature control.[17] If aerators are eliminated, polyvinylchloride fittings are avoided, and water flow and temperature

can be controlled, use of sensor-regulated (electronic) faucets should help reduce the spread of nosocomial infections. As a result, the residential subcommittee suggests adding appendix language to the *Guidelines* to recommend avoiding aerators and polyvinylchloride fittings in electronic faucets and using sensor-regulated faucets that allow control of the water temperature and rate of water flow.

The 2018 Residential *Guidelines* requires hand-washing stations used by care and nursing staff and food service staff to have fittings that allow for hands-free operation. At these hand-washing stations, the residential subcommittee recommends adding a *Guidelines* requirement that hand-washing station fixtures shall not be equipped with aerators but may be equipped with a non-aerating laminar flow device.

Temporary Hand Sanitation Considerations

There is clear evidence that frequent hand-washing is a critical factor in limiting the spread of infectious disease and helping people stay healthy. Even after the COVID-19 pandemic began, inspectors throughout the country found that a third of nurses and nursing assistants in nursing homes did not wash their hands properly before and after contact with residents.[18] During periods of highly infectious disease (e.g., COVID-19 or influenza), immediate and convenient access to hand-washing stations is a critical factor in supporting this necessary behavior and may be accommodated by portable sink units.

Portable sink units can be easily moved into bedrooms and connected to existing or planned plumbing lines to make it easier for staff to engage in compliant hand-washing behavior. Ideally, the portable sink should be positioned so staff members are able to see and talk with the resident while washing their hands. The cost to add a hook-up (hot/cold/drain) at the time of construction is relatively small. The residential subcommittee is not recommending permanent sinks in all bedrooms as that is not consistent with providing a residential environment but believes it is important to have the ability to provide a temporary, portable sink when needed.

Planning for a hand sanitation dispenser located near the entry to a resident bedroom is an acceptable alternative to a portable sink and may be preferred over hand-washing sinks. A portable sink would necessitate the use of a hand-drying method, most likely paper towels, and require a receptacle for towel disposal. A hand sanitation dispenser would eliminate the need for drying and disposal, avoiding the difficulties in mitigating the migration of germs from an open trash container and providing a clean towel for every use. Hand sanitation dispensers may be provided in a consistent location in the entry to each resident bedroom at a height above the floor and in a location that is accessible to staff and residents.

Hand-Drying

A review conducted by Cunrui Huang et al. published in the *Mayo Clinic Proceedings* in 2012 of research into the relative efficacy of paper towels and air dryers[19] concluded that paper towels are superior to electric air dryers from a hygienic viewpoint and thus indicated their use as an infection prevention measure. Studies have found heavier contamination of the immediate environment when hands are dried using a warm air dryer compared to paper towels. The 2018 Residential *Guidelines* requires that all hand-washing stations include a hand-drying device that does not require hands to contact the dispenser. Section 2.4-2.2.8.5 (3) (Hand-washing stations—provisions for drying hands) permits the use of hot air dryers unless the care population dictates otherwise. To minimize the distribution of airborne contaminants, the residential subcommittee recommends hot air dryers be temporarily disconnected and touchless paper towel dispensers with safe disposal be provided during a pandemic.

Additional Considerations

Contact points frequently touched with hands (e.g., handles, knobs, levers, and push plates on operable doors) enable potential cross-contamination during a pandemic. To reduce the number of contact points, hands-free door operations should be considered. For non-latching doors, an out-swinging door is preferred to an in-swinging

one; use of in-swinging non-secured doors should be avoided wherever possible. However, where an in-swinging door is used, it should incorporate hands-free exit operation. Examples of products that provide hands-free operation include automatic door openers and foot pulls.

Common Dining and Amenity Spaces

In trying to contain the spread of COVID-19 and protect residents, many providers limited access to common dining spaces and other activity areas in order to maintain physical distancing. Although this measure was well-intentioned, limiting opportunities for interaction increased feelings of social isolation among residents.

For some living in residential care facilities, dining and amenity-use areas may provide the only opportunity for person-to-person social engagement. Recommendations for safe design of these spaces for use by residents from the American Institute of Architects[20] and information from interviews with providers gathered by the residential subcommittee include these suggestions for making these spaces safer:

- Provide decentralized dining and living spaces in nursing homes, hospice facilities, and some assisted living settings to serve smaller groups of residents. Some providers reported that small-group dining is preferred over in-room dining in these settings because it helps staff observe and assist residents who have difficulty eating independently. Moreover, it allows residents to have personal, physically distanced contact with a consistent group of other residents.
- Separate tables and chairs by a minimum of 6 feet (1.83 meters) using partitions and/or floor markings that indicate required physical distancing.
- Provide more outdoor dining where possible.
- Create a takeout dining area.

Operational recommendations to allow dining and amenity-use spaces to remain open during a pandemic include the following:

- Open the kitchen to the dining area to provide transparency and peace of mind for residents by demonstrating food safety.
- Reduce dining room occupancy by staggering meal times.
- Limit the number of residents using the space at one time.
- Use a reservation system to control capacity and eliminate lines at the dining room entry.
- Use a one-way circulation path for diners and servers.
- Eliminate self-serve options.
- Provide full wait service.
- Provide grab-and-go items for additional food options.
- Increase sanitation and provide PPE in dining rooms and amenity spaces.
- Use touchless payment systems.

Space for Family Visits

Research supported by the National Institute on Aging has found that social isolation and loneliness are linked to increased risk of high blood pressure, heart disease, obesity, a weakened immune system, anxiety, depression, cognitive decline, Alzheimer's disease, and even death. People who find themselves unexpectedly alone due to the death of a spouse or partner, separation from friends or family, retirement, loss of mobility, and lack of transportation are at particular risk.[21]

Many residential care facilities responded to the risks of COVID-19 by restricting or preventing family visitation to limit the introduction of the virus into the home from outside sources, but the strategy had a significant negative effect on resident and family well-being. Some providers strove to minimize the impact through creative measures such as providing dedicated outdoor visitation space, installing temporary structures, partitioning interior spaces with barriers to prevent transmission, and enhancing resident/family communication through technology.

Outdoor Areas for Visitation

Providing outdoor space for visitation not only facilitates social contact, it promotes health and well-being by connecting the resident to nature. Such areas should be located a short distance from the building and provide heating or shade to improve comfort in various weather conditions. They should also be designed to allow visitors to physically distance during infectious disease events. According to provider reports, during the spring and summer of the 2020 COVID-19 pandemic, outdoor space was often used for family visitation. This was primarily due to visitor restrictions enacted to keep COVID-19 from entering the building. As a result, in-person family interactions could only take place through resident room windows or balconies or in an access-controlled outdoor location on campus.

Conversions of Interior Space

To encourage family visitation when outdoor visits were impractical, many of the interviewed providers erected temporary physical barriers out of wood and plexiglass that could be wheeled into a room or semi-permanently installed to divide the room. These visitation spaces were created in unoccupied resident rooms, amenity spaces, and—in the case of Thrive Senior Living—custom-designed for use at the front entrance of buildings.[22]

When temporary visitation spaces are provided during infectious disease events, it is important for staff and residents to access the room through an entrance that is separate from the visitors' entry. This visitation area should have a phone or other communication device and the barrier should provide a clear viewing space of at least 36" × 36" for the resident in a seated position to view the visitor. A hand sanitation dispenser or hand-washing station should also be provided. Surprisingly, some NCAL/AHCA providers interviewed who used this approach found that, despite their best intentions, some residents disliked the arrangement as it reminded them of the type of accommodation made for prison inmates.

Tele-Visit Considerations

During emergency conditions that inhibit physical and family interaction, care providers should encourage and facilitate alternative methods of communication with residents via videoconference technology. Such tele-visits can bridge the social gap until in-person contact is possible. Wireless technology and tablets can be used to provide this connection to families via applications such as Zoom, Skype, Google Hangouts, FaceTime, and social media platforms. With the increased reliance on these web-based services by residents and their families, providers should evaluate the facility's telecommunications bandwidth and augment it if found lacking. Providing the IT and communications infrastructure necessary to support virtual visits is one strategy that can reduce social isolation, but it is not a substitute for direct personal contact.

Support Areas for Staff

Staff members work in direct contact with every point-of-service delivery in a residential care facility. These individuals come from the outside community and may bring undetected infections with them. The COVID-19 pandemic exposed a high level of risk associated with older adults, particularly those living in long-term care settings, which tend to be populated with older adults with multiple co-morbidities that increase their fatality risk.[23]

Provider input solicited by the residential subcommittee led to the following recommendations to limit the spread of infectious diseases in residential care settings: provide dedicated entry points, decontamination facilities for staff, dedicated work areas, sufficient staff storage and convenient access to PPE, staff areas and places for respite, and tools for effective communication.

Dedicated Staff Entry

Controlling, if not eliminating, the introduction of infectious disease at the point of entry is a key element in infection prevention.

Where possible, staff should have a dedicated building entrance/exit that is physically separate from entrances used by residents, visitors, and other services. During infectious disease events, space at the building entry should be provided for health screening per CDC recommendations. Operationally, if a temporary building entry for staff is used, providers should consider relocating time and attendance input devices there in accordance with management policies and procedures.

Decontamination Facilities for Staff

Staff should have an area to change clothes and shower. While there are broader reasons for requiring this during normal operating conditions, it is especially important during infectious disease events. Staff shower and changing areas should be located near the dedicated staff entrance and provide an exit from the care community. Secure storage should be provided in this area that is large enough to accommodate staff seasonal clothing. Ideally, this area would include two access points to facilitate a one-way traffic flow from clean to dirty areas. Storage of unused PPE and disposal for used PPE should be provided along with hand-washing stations and/or hand sanitation dispensers.

These provisions may be impractical in small residential care settings. In these cases, a shower in a resident area may be used in lieu of having a dedicated staff shower if adequate infection prevention measures are implemented and this use is approved by the AHJ.

Dedicated Work Areas

The demands on staff supporting residents in residential health, care, and support facilities are similar to those in acute care environments. As well, in many circumstances, staffing shortages require staff to work in multiple settings in and out of residential health care. This reality increases the potential exposure of staff who work in multiple environments and the risk of cross-contamination to other staff members and the vulnerable resident population. As a result, where

practical dedicated staff work areas should be provided to reduce the cross-contamination potential for residents.

Storage and Access to PPE

Staff working in their primary work area will need access to PPE to conduct their jobs safely. Because PPE will have to be changed frequently, easily accessible decentralized storage should be provided that can accommodate the necessary supplies. Providers have reported that limited staff storage and access to PPE have led to detrimental infection prevention outcomes.

Staff Areas and Places for Respite

Staff should have access to dedicated appliances for food storage and preparation. Consideration should be given for long-term storage of personal items and food during infectious disease events when staff may stay for an extended period beyond their normal shifts. In addition, staff spaces may need to be altered to accommodate physical distancing criteria recommended by the CDC. Temporary signage should be posted to indicate the adjusted occupancy limits of the area.

In addition to break areas, staff should have access to spaces that may be used for meetings and education. During emergency conditions, these spaces may also provide accommodation for overnight stays. Consideration should be given to providing at least one bathroom in close proximity to these spaces. For emotional and physical well-being, staff should have a dedicated outdoor space that is physically separate from those used by residents, visitors, and other services.

Tools for Effective Communication

Communication is especially important during emergencies. For this reason, providers and their design teams should consider the operational methods of communication to be used. A variety of

approaches should be employed, ranging from low-tech solutions (e.g., white boards, bulletin boards) to technology-based solutions such as texting over smartphone devices, pagers, and other types of electronic-based means of communication (e.g., monitors, smart televisions, web interfaces). These communication tools should be leveraged to contribute to infection prevention practices among staff.

Facilities for Support Services

Contracted and centralized support services create opportunities to transmit undetected infections. Preventing such transmission is necessary to reduce the risk of outbreak in residential care communities. Input from providers revealed that precautionary measures employed by senior living communities and care providers helped mitigate the risk associated with support services. The following recommendations are intended to limit the spread of infectious diseases in residential care settings.

Deliveries

Deliveries for the building should be limited to one specific entry point and receiving area. During an infectious disease event, deliveries should be routed to a staging area for disinfection and temporary holding. Consideration should be given to how supplies are sorted and distributed to limit the number of trips required and thereby reduce exposure to staff and residents.

Food Service

During the functional programming stage of a project, consideration should be given to how food delivery services will be managed during an emergency event. This includes food service to large central dining areas and smaller decentralized dining areas as well as delivery to resident rooms. The need for resident monitoring and support during dining should be considered when planning for emergency situations. Some residents may require observation

or assistance while eating and in-room service for these residents may not be practical due to staffing considerations. In these cases, smaller-scaled, decentralized dining areas that enable physical distancing while supporting appropriate staffing ratios for dining assistance and support are preferred.

Laundry

Providers should evaluate infection prevention processes for laundry with a specific focus on personal clothing. For infected residents, laundry should be processed and cleaned in an area separate from the central laundry service area to facilitate segregation and isolation of potentially infected laundry items. This may not be necessary for influenza but could be essential during a pandemic such as COVID-19.

Safe containment of linens, towels, and clothing that may be contaminated from bodily fluids should be provided in a soiled workroom or soiled holding area.

Medication Distribution and Storage

Similar to the food service process, decentralizing medication administration and storage may reduce the transmission of infectious diseases. Providing secured and dedicated medication storage in resident rooms should be considered as both a temporary and permanent solution for the well-being of the resident as well as their caregiving staff. Accommodations for refrigerated medicines in resident rooms should be considered on a resident-by-resident basis.

Oxygen Storage

Consider options for storing oxygen in multiple locations to reduce cross traffic between clean and contaminated areas. Provisions should be made to accommodate the disinfection of oxygen equipment used in resident rooms and other areas.

Waste Management

Trash collection in infected areas should be contained and separated from trash collected from the remainder of the facility. Trash removed from an infected area should not pass through other areas of the facility.

Airborne Infection Control

Controlled entrance access, occupant separation and distancing, wearing of PPE, and disinfectant cleaning are some of the primary defenses against the spread of pathogens and viruses. However, protection from infectious diseases that can be transmitted through aerosols should be added to this arsenal of defenses to minimize transmission of viruses in residential health care facilities, particularly for nursing homes. Airborne transmission is defined as the spread of an infectious agent through dissemination of smaller droplets and particles (aerosols) that remain infectious when suspended in air over distances and time.

The final report of the Coronavirus Commission for Safety and Quality in Nursing Homes[24] recommends consideration of modifications and upgrades to new and existing heating, ventilation, and air conditioning (HVAC) systems in an effort to further modernize and harden facility infrastructure and potentially limit transmission of infectious agents. Consideration should be given to both pandemic (which may be considered temporary) and non-pandemic (permanent) HVAC conditions to reduce the potential spread of infectious diseases in the future. As noted in ASHRAE's Position Document on Infectious Aerosols,[25] there are three ways to mitigate transmission of an airborne pathogen using a mechanical system:

- Trap it (filtration).
- Kill it (disinfection).
- Flush it (ventilation).

From a design perspective, these different approaches typically overlap, and the right strategy depends on whether an HVAC system is in an existing building or planned for new construction.

Temporary Airborne Infection Control

The need to protect residents during infectious disease events, while hopefully rare, is best accommodated by thoughtful facility planning and design, including a mechanical system that provides adequate ventilation, filtration, and temperature and humidification controls. While the norm in hospital design and construction, this design approach is less common in most existing and even newly constructed residential care facilities. When a facility HVAC system is not equipped to provide airborne protection, several rapidly deployable temporary solutions may enable a facility to provide a suitable response and appropriate safety accommodations for residents and caregivers during emergencies.

Portable HEPA filtration systems

Use of portable high-efficiency particulate air (HEPA) filtration systems has been shown to be an effective method of providing airborne infection control when employed correctly. Guidance for these strategies has been developed by the CDC and the National Institute for Occupational Safety and Health (NIOSH) as well as state health departments and is available online.[26]

Ventilated headboards

A ventilated headboard captures and contains contaminants close to infected patients via an exhaust and HEPA filter system integrated into a headboard. Advantages of the ventilated headboard enumerated by[27] NIOSH are as follows:

- Proven—successfully captured/removed more than 99 percent of airborne infectious aerosols during laboratory testing with the NIOSH droplet nuclei test protocol

- Cost-effective—cost per isolated patient environment is considerably less than traditional airborne infection isolation rooms
- Personnel protection—health care personnel operate outside the "hot zone" of infectious aerosols
- Easy patient access—open front allows interaction between the patient and room occupants/equipment
- Expandable—for one or multiple units
- Highly adaptable—adjusts to fit most sizes of hospital bed, shelter cot, or gurney
- Fast setup—quick and easy installation
- Easy breakdown for storage—can be stored and set up quickly

Details of ventilated headboards, including do-it-yourself instructions, can be found on the CDC website.[28]

Negative pressure room using a portable HEPA filtration system

With this strategy, space is negatively pressurized using an exhaust fan (either directly ventilated to the outside or connected to the existing exhaust system) with integrated HEPA filter to prevent contaminants from spreading outside the room. Although this strategy is more typically employed in a hospital setting, during an infectious disease event, expedient establishment of a negative pressure room may be useful in a residential health care setting where traditional airborne isolation or negative pressure rooms are not available. For the continued safety of residents, staff, and the public, this type of conversion/installation must be coordinated with local AHJs.

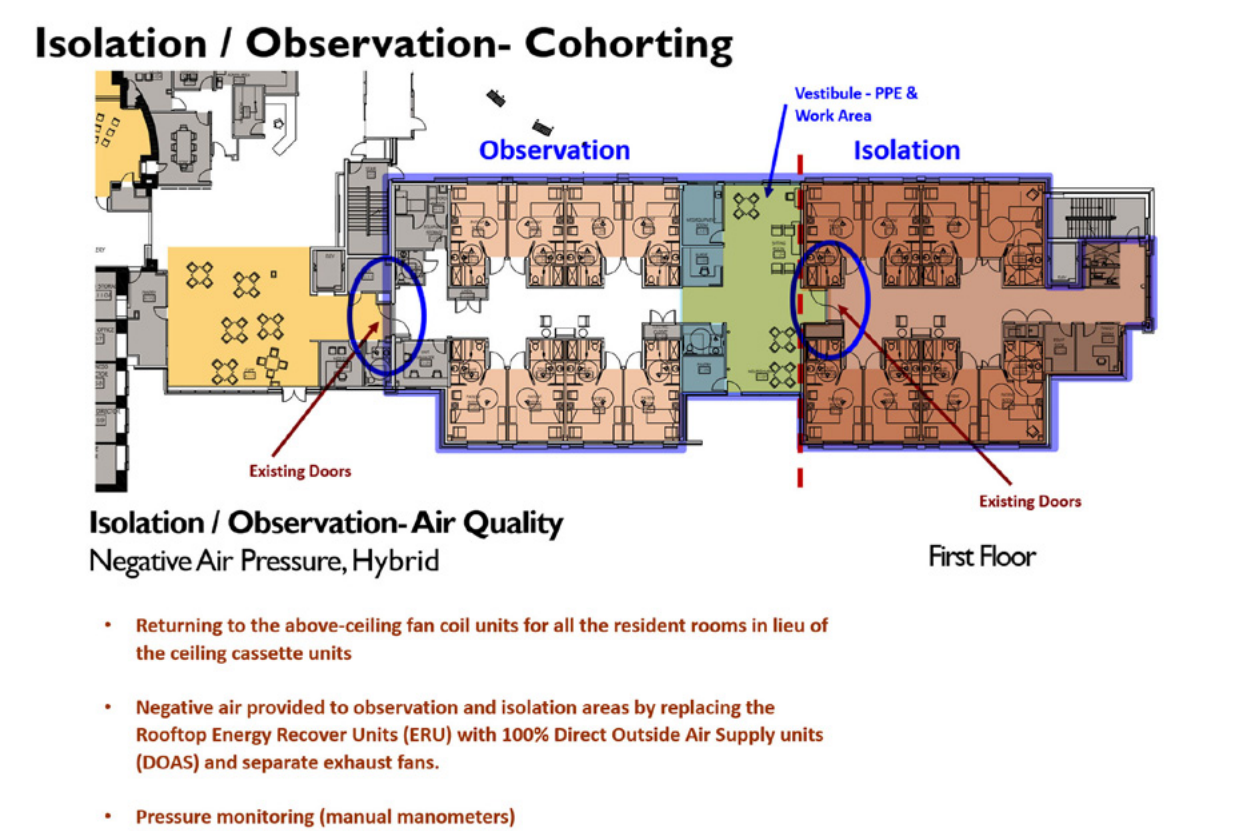
Permanent Airborne Infection Control

Permanent environmental airborne infection control measures are recommended in residential health care environments to reduce the concentration of infectious particles. The following airborne infection control categories represent the major strategies for reducing airborne infectious particles:

- HEPA filtration
- Negative pressure and/or airborne infection isolation units
- Humidification to 40 to 60 percent relative humidity levels
- Air dilution via natural or mechanical ventilation
- Air purification
  - Ultraviolet germicidal irradiation light (UVGI) in the central air distribution system
  - Bipolar ionization

A good deal of information on these types of systems was collected by the ASHRAE Epidemic Task Force and can be found on

Figure 7-4: COVID-19 Renovations to Parker Life in Somerset, N.J.



At Parker Life, in Somerset, N.J., COVID-19 isolation and observation areas were created by (1) isolating the spaces using existing doors and (2) providing negative pressure to them by replacing rooftop energy recovery units with 100 percent direct outside air supply units and separate exhaust fans.

Source: Parker Life, Sponsor/Spiezle Architectural Group, Inc., Architect of Record

the "Technical Resources: Filtration/Disinfection" page on the ASHRAE website.[29]

HEPA filtration

To trap airborne particles, consider the use of high-efficiency filtration for return air systems. The higher the filter grade, the better the air can be purified before it returns to the room. Filters can range from 95 percent efficient (0.5 microns) to 99.9995 percent (0.12 microns). Without filtration, particle concentrations accumulate in indoor environments, which can cause toxic effects even in healthy people.

In existing mechanical systems, increasing the filtration level may be done with minor effect on the existing system. However, the ability to raise the filtration level in existing systems could depend on the air pressure available in the system, and some systems may not allow a substantial increase in filtration before creating back pressure that causes the fan to fail. In new construction, systems can be designed for high-efficiency filtration with appropriate consideration for larger ducts and fan capability.

Theoretically, infected aerosol droplets could be dispersed through an HVAC system and spread to other occupants, but this scenario appears unlikely and there is no evidence to date. Because of this lack of evidence and the difficulty and cost of providing an HVAC system with a substantially higher filtration level, other strategies for airborne infection control may be more effective in residential care facilities.

Negative pressure rooms

The purpose of creating negative air pressure in hospital rooms is to contain airborne contaminants in the room. In acute care facilities, airborne infection isolation (AII) rooms are designed for negative pressure in relation to adjacent rooms and hallways. This reduces the potential for airborne respiratory droplets to travel on air currents from the patient into hallways where they can be further transported into surrounding areas.

As mentioned above, during emergency events, strategies have been used in nursing homes to temporarily modify resident rooms by placing a portable HEPA filter machine and connecting it to the exhaust or directing it to the outside. Permanent conversion of a large number of resident rooms to negative pressure is impractical and adds significant construction and operating costs. A true hospital-grade AII room cannot use energy recovery systems and therefore discharges all air changes to the outside. This unsustainable energy loss is unlikely to meet most energy codes.

Humidification

Relative humidity is an important consideration in any HVAC system. Studies have shown that pathogens have a difficult time surviving at higher relative humidity levels. This is of particular importance to residential settings in cold climates during winter. In addition, "…our natural respiratory defenses are quickly impaired at 20 percent relative humidity, resulting in increased susceptibility to respiratory infections such as COVID-19," says Stephanie Taylor, MD, MArch, CIC.[30] Relative indoor humidity levels above 60 percent, however, can also have negative effects (e.g., mildew growth). Providing HVAC equipment capable of maintaining a tighter range of humidity (40 to 60 percent) can mitigate pathogens without causing other adverse effects.

Air dilution via natural and mechanical ventilation

Building ventilation is the intentional movement of air to bring outdoor air inside and mix it with preconditioned air. Building codes require a minimum ventilation rate of outdoor air. If outdoor air intakes are properly located, areas adjacent to the intakes are properly maintained, and the air is filtered, outdoor air exchanges can dilute and remove contaminants.

In ANSI/ASHRAE/ASHE Standard 170: *Ventilation of Health Care Facilities*, central ventilation system requirements for nursing home resident rooms are two minimum outdoor air changes per hour and two minimum total ACH with a MERV-13 filter and no required pressure relationship to adjacent areas. Older nursing homes with areas

not served by central HVAC systems often use through-the-wall or fan coil air-conditioning units as the sole source of room ventilation. A through-the-wall fan can provide outdoor air into a room, but if it is an extract fan, then providers will need to consider the air composition and whether it is "fresh" by its ability to add outside air. A fan coil air-conditioning unit recirculates air to heat or cool the space and may not be providing fresh air to the space. It is possible fresh air is ducted to a fan coil unit, but this should be confirmed. These systems can meet minimum code requirements, but careful consideration will be needed to determine if they provide fresh air, and, if they do, what flow rate they provide. If a resident room is equipped with an individual through-the-wall fan coil unit, that room should not be used for infectious residents because these units cannot accommodate MERV-13 filtration or humidification-type applications.

In new construction, consider central mechanical systems that allow increased levels of outside air into the building. Design of such ducted HVAC systems involves configuring the system to increase the rate of exchange with fresh air from outside the building to reduce recirculation. In buildings with old or inflexible systems, consider supplementing the HVAC by installing high-performance air purification systems, as discussed in the next section.

Air purification

A word of caution when considering UVGI and bipolar ionization systems: Although they are available on the market, research in some instances is lacking (see the section below on needed research) and consistent standards of efficacy may not be available. The maintenance needs of these system are also a concern.

Ultraviolet germicidal irradiation light/recirculation

The use of UVGI light can be a means of eliminating various bacteria and viruses from the surfaces of mechanical systems. However, UVGI has only a minimal effect on fungal spores, which means applications for sanitizing surfaces need to be carefully considered. As well, because of the well-known safety concerns of ultraviolet light, shielding is needed to prevent direct exposure to skin or eyes.

In ducted irradiation systems, UVGI lamps are placed inside central air-handling systems or local ducts so that air to these rooms is disinfected before it is recirculated. However, evidence is inconclusive as to whether UV light from most currently available UV light technology effectively sanitizes the air; concerns are the exposure time needed and the air speed provided in typical mechanical systems.[31]

Bipolar ionization

In new construction or renovation, installing bipolar ionization equipment throughout the facility should be considered. Bipolar ionization using low-voltage (24V) units injects ions into the supply air stream and the occupied space without producing byproducts such as ozone. Because the ionization treatment is provided on the supply side of the mechanical system, it is considered a disinfectant to the room air and has the same effect regardless of the number of air changes in the room. This system can be added effectively in very old buildings where there are no significant air changes. A bipolar ionization system is likely to have the lowest first cost and operating cost of all the airborne infection control systems.

Although research regarding coronavirus is ongoing, some similarities have been identified by experts. SARS, MERS, and COVID-19 severely affect the upper respiratory system and manifest similar symptoms. Bipolar ionization is effective at deactivating 99.4 percent of COVID-19 within 30 minutes of the start of operation. It inactivates pathogens (e.g., viruses, bacteria, mold) by stealing hydrogen, which breaks down pathogens into harmless compounds like oxygen, carbon dioxide, nitrogen, and water. Bipolar ionization reduces particulates in the air by drawing the particles together, thereby increasing their size and mass so they are more effectively trapped in air filtration systems. Bipolar ionization is a strategy that is particularly suited to buildings types that provide high levels of outside air into the building.

General Mechanical Design Considerations to Limit Infection

Zoning is of particular importance in designing a residential health care building to assist in limiting airborne infection during a pandemic. Per ASHRAE 170, "[z]oning (using separate air systems for different resident clusters) may be indicated to:

- Compensate for exposures caused by orientation or for other conditions imposed by a particular building configuration.
- Minimize recirculation between clusters.
- Provide flexibility of operation.
- Simplify provisions for operation on emergency power.
- Conserve energy.

A zone serving a cluster of rooms with a common HVAC unit allows for better segregation of a portion of the facility when needed for use as an infectious disease isolation unit. This same approach would also better allow for conversion of the cluster to operate as a negative pressure or airborne isolation unit should the need arise.

Essential Electrical Systems

The power losses experienced in nursing homes after Hurricane Irma in 2017[32] made clear that emergency power systems, as required by NFPA 99: *Health Care Facilities Code* and NFPA 110: *Standard for Emergency and Standby Power Systems*, need to be proactively assessed to assure they can support continued operations during emergency conditions. The duration of emergency events can be unpredictable and to meet extended needs, fuel supply provisions should be greater than what is required for minimum operational periods. The Federal Emergency Management Agency established the 96-hour process because it takes time to mobilize and stage after an event.[33]

As public utility systems continue to add loads and areas impacted by severe weather become more widespread, the need to maintain

power systems as required under CMS rules is better understood.[34] In Section 6.4.1.1.7.3 of NFPA 99, load shedding is required for loads except life safety and critical branches. Some states have adopted more stringent regulations on maintaining temperatures in facilities while operating emergency power sources.[35] Provision of generator sets to supply additional HVAC systems and equipment should be considered for renovation projects and new construction.

During an event causing a loss of normal power, the protection and welfare of residents remains the priority. Adequate connections to equipment for meal storage and preparation is a very important consideration during extended periods of operation on emergency power. As well, consideration should be given to supplying emergency power to access control systems, as allowed on the life safety branch. Being able to sustain facility operations for extended durations is necessary to protect and support residents under emergency conditions.[36] The emergency power supply system should be evaluated as projects are planned and the facility's hazard vulnerability or disaster, emergency, and vulnerability assessment dictates. The ability to protect residents during emergency events will reduce the potential for evacuation and make it possible to sustain safe facility operations during emergency conditions.

Telehealth and Telemedicine Considerations

During the COVID-19 pandemic, telehealth visits from providers to families and patients increased by an estimated 1,000 to 3,000 percent, according to the U.S. Department of Veterans Affairs.[37] The U.S. Health Resources & Services Administration defines telehealth as "the use of electronic information and telecommunications technologies to support long-distance clinical health care, patient and professional health-related education, public health, and health administration. Technologies include videoconferencing, the internet, store-and-forward imaging, streaming media, and terrestrial and wireless communications."[38]

An expanded section on telemedicine was drafted for the 2022 FGI *Guidelines for Design and Construction of Residential Health, Care, and Support Facilities*. Telehealth is different from telemedicine because it refers to a broader scope of remote health care services. While telemedicine refers specifically to remote clinical services, telehealth can refer to remote non-clinical services, such as provider training, administrative meetings, and continuing medical education in addition to clinical services.[39]

Many types of care settings can benefit from telehealth technology, including residential facilities.[40] Providing remote access to health care through telehealth services allows residents to maintain continuity of care and avoid additional negative consequences from delayed preventive, chronic, or routine care.[41] These services may include Medicare telehealth visits, virtual check-ins, and e-visits. Care organizations need to evaluate whether their IT infrastructure is robust enough to support increased use of such services.

Real-Time Location Systems

A real-time location system (RTLS) is a system used to provide real-time tracking and management of equipment, staff, and patients in all types of patient care environments. Care organizations should evaluate where contact tracing or monitoring and management of equipment, staff, and patients could address their vulnerabilities and consider providing an RTLS.

These systems give facilities the ability to perform contact tracing, including running reports, and analyses based on locations, patient and staff interactions, length of interactions, and so on. Various infrastructure technologies can help with RTLS deployment and scalability. Technologies such as Wi-Fi, ultrasound, radiofrequency identification, and Bluetooth Low Energy each require their own infrastructure planning but can be deployed collectively to maximize coverage and locating density but limit initial cost barriers, which can be a significant deterrent in residential facilities.[42]

RTLSs can be integrated with door hardware to support touchless technology and reduce touchpoints at entrances and exits. Once a staff member's identity has been verified, the technology can automatically unlock and open doors.

Communication Systems

Communication and technology systems have a pivotal role in ensuring business continuity and effective facility operations during emergency conditions. In the event alternate care sites (e.g., tents, modular units) are required to respond to an emergency event, protective actions for life safety, including network connectivity, should be provided to assure reliable communications between

Figure 7-5: Mobile Medical Unit

Shown is an example of a mobile medical unit that could be set up in a predetermined exterior emergency response space and connected to the facility network via an exterior fiber termination box.

Source: *The Texas Tribune*, https://www.texastribune.org/2020/03/13/drive-through-coronavirus-testing-comes-san-antonio-texas/

sites. For example, connectivity between sites could be provided via an exterior fiber box that has fiber connectivity to the facility core network and allows an external network to be set up outdoors. The exterior fiber box could be located on the exterior wall of a predetermined emergency response space or in a fiber distribution terminal that services residential care units. Wireless access points could be installed in the exterior fiber termination box to service exterior areas.

Figure 7-6: Fiber Termination Box

An exterior fiber termination box can provide connectivity to electronic medical records, patient information, and other communications in a secure environment.

Source: AFL

Gaps in Current Knowledge and Future Research Opportunities

As this paper was being written, knowledge of the manner in which COVID-19 could be transmitted continued to be develop. However, it is generally understood that both symptomatic and asymptomatic individuals can carry the virus and infect those

around them. The World Health Organization and the CDC have found evidence of droplet and aerosol transmission of the virus. The residential subcommittee has provided information that can be used to understand strategies and approaches for addressing airborne infection control, but, at this time, there is no documentation of disease transmission through HVAC equipment. For this reason, and because research and consistent standards of efficacy are lacking around air purification systems, the residential subcommittee determined that only very limited changes to the *Guidelines* requirements on HVAC equipment would be appropriate until a wider base of qualitative research around transmission of COVID-19 by mechanical equipment is available. This should be a priority for future research.

Recommended Guidance for Emergency Conditions

It is understood that pandemics are 100-year events. As one member stated during a residential subcommittee meeting, it was not the charge of the subcommittee to create new *Guidelines* language that would unnecessarily force providers and architects to build a monument to COVID-19. However, the COVID-19 pandemic certainly illustrated that guidance for mitigating infectious disease has been lacking in the Residential *Guidelines*. Most of the recommendations made by the subcommittee are suggested for inclusion in the Residential *Guidelines* as appendix language due to their advisory nature.

Five items, however, were identified as warranting a required change. This new language would provide showers for staff; clarify requirements for faucets used by care, nursing, and food service staff; require a single point of access for deliveries; require private rooms for residents; and provide accommodations for safe visitation.

The first proposed change, a requirement that staff have a shower and place to change clothes, was a simple matter of moving existing appendix text for the staff toilet room to a stand-alone requirement

(separate from the staff toilet). The second, that faucets used by care, nursing, and food service staff can employ non-contact, sensor-regulated technology and that these faucets must not be equipped with aerators, is a clarification of an existing requirement. The third, requiring deliveries to be limited to one specific entry point/receiving area, also was seen as a clarification of the existing receiving area text as opposed to a requirement that was entirely new.

The significant new proposed requirements are focused on design standards that protect lives and increase the quality of life for residents when emergency situations such as pandemics or epidemics occur. The requirement for single-resident room occupancy in new nursing homes, hospice facilities, assisted living settings, and long-term residential substance abuse treatment facilities was supported by research prior to the pandemic. Emerging evidence and provider reports regarding the decreased incidence and spread of COVID-19 in residential facilities with private rooms confirmed that the time for making this a minimum requirement is now. Therefore, the residential subcommittee developed language that makes single-occupant rooms the norm but allows provision of double-occupancy rooms when the need is demonstrated and approved by the authority having jurisdiction.

The requirement to provide a room to facilitate safe visitation in new nursing homes, hospice facilities, assisted and independent living settings, long-term residential substance abuse treatment facilities, and settings for individuals with intellectual and/or developmental disabilities is overwhelmingly supported by subcommittee members. Provision of a visitation room should also be considered by existing facilities looking to provide safe, indoor visitation space.

The toll of the social isolation forced on elders during the COVID-19 pandemic when safe visitation spaces were not available in most residential health, care, and support facilities is yet to be fully understood, but reports from providers have noted that depression scores in their facilities have gone up exponentially. The residential subcommittee felt the visitation room proposed by the province of Manitoba (Appendix 7-2) for personal care homes had the correct approach and was supported by research. This solution has the right safeguards in place and was sensitive to balancing

costs. Thus, the group recommends that a similar type of visitation space, with similar prescriptive requirements, become a part of the residential environments included in the Residential *Guidelines*.

See the recommended *Guidelines* language from the subcommittee at the end of this chapter and in the draft *Guidelines for Emergency Conditions in Health and Residential Care Facilities* at the end of the white paper.

It is the subcommittee's hope that the information presented here proves helpful to providers, architects, designers, and authorities having jurisdiction as they work to adapt existing facilities and create new environments to better respond to pandemic and other emergency conditions in the future.

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Proposed Language Based on the 2018 Residential *Guidelines*

The proposed new language below shows changes to the 2018 FGI *Guidelines* recommended by the residential subcommittee of the Emergency Conditions Committee. Additions are underlined, and deletions indicated with a ~~strikethrough~~. Where an appendix item (i.e., a non-enforceable recommendation or guidance on applying a requirement) has been provided, an asterisk (*) precedes the section number (e.g., *1.2-4 Safety Risk Assessment). Appendix items can be identified by the letter "A" that precedes the correlating section number (e.g., A1.2-4 SRA). The text shown has been excerpted from the 2018 *Guidelines* and is not comprehensive. These proposed changes have been adapted and incorporated with recommended changes from other subcommittees in the draft *Guidelines for Emergency Conditions in Health and Residential Care Facilities* in the last section of this white paper.

Chapter 1.2, Planning/Predesign Process

…

1.2-2.2.2.2 Explanation of the functional requirements for the project shall cover, at minimum, the following:

…

(2) Operational circulation patterns. These shall include interior and exterior circulation patterns for:

*(a) Residents, staff, and family/visitors

A1.2-2.2.2.2 (2)(a) Consideration should be made for how building circulation will affect food delivery during

emergency situations. Providers should consider how staff work areas can be identified to minimize unrelated travel through the other areas of the facility.

(b) Equipment for infectious waste handling

…

(4) Short- and long-term planning considerations. These shall include the following:

(a) Flexibility and future growth

(b) Impact on existing adjacent facilities

(c) Effect on existing operations

(d) Integration of technology and equipment

(e) Changes in resident population over time, including cognitive and physical abilities

(f) Provisions for end-of-life care for residents and support of families

(g) Potential impacts of decentralizing food service to serve smaller groupings of residents during emergency situations.

(h) The operational methods of communication, especially during emergencies. This may include a variety of approaches including but not limited to technology needs and centralized visual messaging.

1.2-3.1.1 RSRA Requirement

***1.2-3.1.1.1** Every new or renovated residential health, care, or support facility shall be designed to facilitate safe delivery of care consistent with the level of care outlined in the functional program.

1.2-3.1.1.2 To support this goal, ~~a resident safety risk assessment shall be developed and completed by an interdisciplinary team~~ a multidisciplinary team shall review the organizations' hazard vulnerability assessment (HVA) in conjunction with the development of a resident safety risk assessment (RSRA).

***1.2-3.1.2 RSRA Components**

The RSRA shall address how the physical environment of the residential health, care or support facility may affect resident safety outcomes and shall include assessment of the components identified in Table 1.2-1 (Resident Safety Risk Assessment Components).

> **A1.2-3.1.2 RSRA components.** The resident safety risk assessment should also address how the physical environment of the residential health, care or support facility can help maintain residents' functional capabilities.
>
> For additional information on safety outcome categories incorporated in the RSRA component descriptions, see a literature review undertaken by the Center for Health Design (CHD): "Summary of Literature Review: Resident Safety Risk Assessment"(July 2012) on the CHD website (www.healthdesign.org). See the Facility Guidelines Institute website (www.fgiguidelines.org) for a RSRA matrix based on six categories of resident outcomes identified in the CHD literature review.

1.2-3.1.3 RSRA ~~Timing~~ Responsibility and Scope

1.2-3.1.3.1 The resident safety risk assessment shall be initiated by the care provider during the functional programming phase of the health, care, or support facility project (i.e., before construction begins) and continue through project construction and commissioning as applicable.

1.2-3.1.4 RSRA Team

1.2-3.1.4.1 The care provider shall appoint an interdisciplinary team to conduct the resident safety risk assessment. The multidisciplinary team shall review the organization's hazard vulnerability assessment in conjunction with the development of a disaster, emergency, and vulnerability assessment (DEVA).

***1.2-3.1.4.2** The RSRA team shall include stakeholders for the identified project

> **A1.2-3.1.4.2 RSRA team members.** Project stakeholders may include the following as well as others, depending on the nature and needs of the project:
>
> a. Maintenance and environmental services staff
>
> b. Safety, security and transportation staff
>
> c. Direct care staff
>
> d. Quality assurance staff
>
> e. Activity staff
>
> f. Management staff
>
> g. Therapy staff
>
> h. Planning and design professionals
>
> i. Residents and family members
>
> j. Emergency preparedness officers
>
> k. Risk management professionals
>
> l. Insurance provider

1.2-3.1.4.3 Members of the team shall be convened as a group as needed to maintain continuity and integration of the RSRA components.

1.2-3.1.4.4 Individual members shall be engaged to develop additional detail according to their areas of expertise.

***1.2-3.1.5 RSRA Process**

The care provider shall ~~complete a resident safety risk~~ provide an assessment ~~to determine~~ of the potential ~~risks~~ hazards for ~~and resulting impacts to~~ residents~~, and~~ caregivers, and other users for ~~each space and building~~ the components listed in Table 1.2-1 (Resident Safety Risk Assessment Components), identifying hazards specific to the project.

> **A1.2-3.1.5 Hazards.** Hazards include circumstances, processes, human activities, physical obstacles, and underlying conditions that may directly or indirectly contribute to harm to patients, staff, or other users or contribute to damage or loss.
>
> Some hazards may be more anticipated than others (e.g., those with a regionally based likelihood). Anticipated hazards may come with some level of advance notice, minutes or hours for a tornado or days for a hurricane. Other hazards may be unanticipated (e.g., an explosion of stored chemicals or terrorist attack). Some hazards may start as an unanticipated event and evolve into an anticipated event (e.g., a global pandemic).

1.2-3.1.5.1 Evaluate hazards and risks. ~~**Identify risks. For each space in the building, the RSRA shall identify the following specific categories of risk:**~~ The RSRA team shall evaluate underlying conditions that contribute to an unsafe environment for the components listed in Table 1.2-1 (Resident Safety Risk Assessment Components) and estimate associated risk considering:

(1) ~~Infection control risk~~ Likelihood (vulnerability), using historical data and/or national patient and caregiver safety trends relevant to the identified hazards

(2) ~~Resident mobility and transfer risk~~ Consequence, the estimated degree of potential harm to patients and/or caregivers from the identified hazards

~~(3) Resident fall risk and prevention~~

~~(4) Resident dementia and mental health risk~~

~~(5) Medication error risk~~

~~(6) Security risk~~

~~(7) Disaster risk and emergency preparedness~~

~~*~~1.2-3.1.5.2 Evaluate ~~risks and~~ opportunities to enhance quality of life.

~~(1) The care population profile (including cognitive abilities of residents) identified during the functional programming process shall be used as a basis for evaluating resident safety-related risks and quality-of-life opportunities.~~

~~(2) Identified risks should also be evaluated for the following:~~

~~(a) Likelihood of occurrence based on historical data, if available~~

~~(b) Degree of potential harm to residents~~

~~(3)~~ Identified quality-of-life opportunities shall be evaluated for the following:

(1) ~~(a)~~ Likelihood of opportunity based on historical data, if available

(2) ~~(b)~~ Degree of potential enhancement to resident quality of life

~~**A1.2-3.1.5.2 Evaluation of risks and opportunities to enhance quality of life**~~

~~a. Each space should be assessed for the presence of harmful, stress-inducing agents or latent conditions as~~

well as for opportunities to mitigate those conditions to enhance quality of life. Examples include the following:

- Noise and vibration
- Visual distraction
- Light type, quality, and quantity, including lighting that addresses specific tasks and promotes ease of ambulation
- Surface characteristics, including environmental sources of infection
- Indoor air characteristics, including environmental sources of infection
- Ergonomics, including design features that contribute to staff fatigue
- Space requirements, including space adjacencies that do not support the care model
- Visual disorganization of space, including lack of standardization in layout and location of spaces and equipment
- Impediments to resident movement and ambulation, including environmental hazards that may cause residents to slip, trip, or fall
- Impediments to staff movement and work flow, including environmental hazards that may cause staff to slip, trip, or fall
- Communication, including design features that may hinder communication between staff members, residents and staff, residents and family members, and staff and family members.
- Space requirements that may unduly limit auditory, visual, and/or lighting control by residents and family

~~*~~**1.2-3.1.5.3 ~~Prepare RSRA reporting and comply with the recommendations provided~~ Generate solutions.** Document proposed solutions that mitigate risk of the identified hazards.

***1.2-3.1.6 RSRA Report**

After completing the RSRA process, the care provider shall provide the following information and recommendations, which shall be incorporated into the planning and design documentation:

A1.2-3.1.6 RSRA report

Time and effort should be dedicated to resident and caregiver safety issues during the predesign phase (e.g., strategic planning, master planning, operational planning, and programming) of a residential health, care and support facility project. The decisions made during predesign significantly affect the design parameters going forward and the safety outcomes of the project following occupancy. The RSRA should be an important part of the continuous safety improvement program in any care organization.

Organizations are required to conduct hazard vulnerability assessments (HVAs). Design solutions that support the safe delivery of care during disasters and emergencies should be coordinated with and supplement existing mandated HVAs. The intent of this portion of the assessment is to proactively understand the role of the built environment (beyond critical infrastructure) in solutions that mitigate risk.

Requirements for submission may vary by AHJ, and may not be required until permitting, but this does not preclude the benefit of early planning and documentation to ensure integrated solutions that mitigate risk in the built environment.

***1.2-3.1.5.3 Prepare RSRA reporting and comply with the recommendations provided.**

A1.2-3.1.5.3 Where available, benchmarked resident and caregiver safety data and national industry resident and caregiver safety trends should be used as a benchmark for developing the report.

(1) The RSRA team shall produce a written report that:

(a) Identifies known environmental risks based on RSRA components to be used in development of the functional program and in the design, construction, and commissioning of a residential health, care or support facility:

(i) Infection control risk

(ii) Resident mobility and transfer risk

(iii) Resident fall risk and prevention

(iv) Resident dementia and mental health risk

(v) Medication error risk

(vi) Security risk

(vii) Disaster risk and emergency preparedness

(b) Specifies design features intended to reduce or eliminate potential risks from adverse events for inclusion in the project design

(2) The conclusions in the written report shall:

(a) Be incorporated into the functional and physical space programs.

(b) Remain an active component of the following project documents:

(i) Planning, design, equipment and furniture specifications

(ii) Construction documentation

~~(iii) Commissioning records~~

~~(iv) Postoccupancy evaluation documents~~

~~(3) Changes to the original design plans and as-built documentation, including changes in identified risks and solutions, shall be recorded, updated, and shared among RSRA team members throughout project design, construction, and commissioning.~~ [Relocated to Section 1.2-3.1.7.2 (2).]

1.2-3.1.6.1 Resident and caregiver safety risks identified by the RSRA

1.2-3.1.6.2 Opportunities to improve the quality of life for residents for inclusion in the project design

1.2-3.1.6.3 Design features that contribute to the identified hazards and risks

1.2-3.1.6.4 Design strategies being implemented to reduce, mitigate, or eliminate identified hazards and risk and improve quality of life

1.2-3.1.7 RSRA Compliance

1.2-3.1.7.1 RSRA documentation

(1) Written records shall remain an active part of the project documents for the duration of design, construction, and commissioning.

(2) The records shall include the RSRA recommendations report and any documentation completed as part of the RSRA process.

1.2-3.1.7.2 RSRA communication

(1) The RSRA team shall provide updates to the planners and designers for compliance with additional levels of detail generated during the project for all safety components listed in Table 1.2-1 (Resident Safety Risk Assessment Components).

(2) ~~1.2-3.1.5.3 (3)~~ Changes to the original design plans and as-built documentation, including to changes in identified risks and solutions, shall be ~~recorded~~ documented, updated, and continually shared ~~among~~ between the RSRA team ~~members~~ and the designers, planners, governing body, and contractor. ~~throughout project design, construction, and commissioning.~~

***1.2-3.8 Disaster, ~~Risk and~~ Emergency ~~Preparedness~~, and Vulnerability Assessment**

A1.2-3.8 Disaster, ~~risk and~~ emergency ~~preparedness~~, and vulnerability assessment. Residential health, care, and support facilities generally are expected to be functional, safe and secure for residents, family members, visitors, and staff while remaining prepared for natural and man-made emergencies 24 hours a day/7 days a week.

a. ~~An evaluation of potential risks from disasters informs the emergency preparedness plan.~~ The disaster, emergency, and vulnerability assessment should include information developed as part of any facility-based hazard vulnerability assessment, more specifically addressing the emergency preparedness program as it pertains to the proactive design or renovation of the facility.

b. The design ~~Design~~ of the facility should consider emergency management practices that allow for the flexibility and resilience required to manage emergency events.

c. ~~A potential risks~~ An all-hazards approach to ~~the~~ design should be applied to help the ~~care provider~~ facility prepare for, respond to, and recover from man-made events and natural disasters.

***1.2-3.8.1 Disaster, Emergency, and Vulnerability Elements of the Resident Safety Risk Assessment**

A1.2-3.8.1 A range of hazards and vulnerabilities should be considered. A facility-based disaster, emergency, and vulnerability assessment should include, but is not limited to:

a. Review of anticipated (e.g., earthquake, hurricane, nuclear facility accident) and unanticipated (e.g., explosion, infectious disease, hazardous material) hazards

b. Resident/participant/client population (e.g., acuity, ability levels)

c. Facility type and potential surrounding community assets (rural area will differ from a large metropolitan area)

1.2-3.8.1.1 Anticipated hazards. The RSRA report shall identify anticipated hazards specific to a facility based on its geographic location.

***1.2-3.8.1.2 ~~Provisions for disaster preparedness~~ Design features.** Design features that provide resilience, hardening, flexibility, and adaptability during a disaster or emergency event shall be identified.

A1.2-3.8.1.2 Design features ~~Provisions for disaster preparedness~~

a. *Design for continued operation.* For those facilities that must remain operational in the aftermath of a disaster, special designs are required to protect systems and essential building services such as power, water, medical systems, and, in certain areas, air conditioning systems. In addition, special consideration must be given to the likelihood of temporary loss of externally supplied power, gas, water, and communications.

b. *Wind- and earthquake-resistant design for new buildings*

—Facilities should be designed to meet the requirements of American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI) 7 or building codes with substantially equivalent requirements. See Section 1.1-4.2 (Regulations for Earthquake-Resistant Design for New Buildings) for specifics.

—Seismic construction inspection. During construction, the care provider should complete the testing described in Section 11A.2 and special inspection of the seismic systems described in Section 11A.1.3 of ASCE/SEI 7.

—Roof considerations

- Roof coverings and mechanical equipment should be securely fastened or ballasted to the supporting roof construction and provide weather protection for the building at the roof. If ballast is used, it should be designed so it is unlikely to become a projectile.

- In addition to the wind force design and construction requirements specified, particular attention should be given to the design of roofing, entryways, glazing, and flashing to minimize uplift, impact damage, and other damage that could seriously impair building function.

c. *Design to mitigate the potential for progressive collapse.* Design guidelines for the prevention of progressive collapse typically take a threat-independent approach that, regardless of initial cause, is intended to develop inherent robustness and continuity in the structure to resist and arrest propagation of failure.

d. *Flood protection*

—In accordance with Executive Order 11988: Floodplain Management, possible flood effects should be considered when selecting and developing the site for a residential health, care, or support facility.

—Insofar as possible, new facilities should not be located on designated floodplains.

—Where locating a facility on a floodplain is unavoidable, consult the U.S. Army Corps of Engineers' regional office for the latest applicable regulations pertaining to required flood insurance and protection measures.

e. *Emergency supply storage*

—Required supplies. Should normal operations be disrupted, the facility should have adequate storage capacity for, or a functional program contingency plan to obtain food, sterile supplies, medication supplies, linen, and water for sanitation.

—Storage capacity. Such storage capacity or plans should be sufficient for at least four continuous days of operation.

f. *Design to address pandemic*

—Facilities should be designed to support design recommendations from the Centers for Disease Control and Prevention (CDC) to limit the spread of infection.

—During a pandemic, staff should have dedicated space, accommodations, and supports to facilitate overnight stays in the facility.

***1.2-3.8.2 ~~Compliance Elements~~ Disaster, Emergency, and Vulnerability Response**

~~**1.2-3.8.2.1** In locations with recognized potential for hurricanes, tornadoes, flooding, earthquakes, or other regional disasters, the need to protect the life safety of all residential health, care, and support facility occupants and the potential need for continuing services following such a disaster shall be considered during project planning and design.~~

~~**1.2-3.8.2.2 Disaster preparedness plan**~~

~~(1) A disaster preparedness plan for the new construction or renovation project shall be included in the RSRA report.~~

~~(2) This plan shall include disaster planning risk mitigation recommendations prepared by the multidisciplinary team that address the following:~~

1.2-3.8.2.1 Documentation. The design team shall incorporate the identified disaster and emergency-related design features in the project design documents.

1.2-3.8.2.2. In addition to the emergency-related design features, the disaster, emergency and vulnerability response shall include disaster planning risk mitigation recommendations that address the following:

(1) ~~(a)~~ Resident placement and relocation

(2) ~~(b)~~ Standards for barriers and other protective measures required to protect areas of refuge from identified potential disasters

(3) ~~(c)~~ See Section 1.2-3.2 (Infection Control Risk Assessment) for additional information and requirements.

~~**A1.2-3.8.2 Disaster preparedness compliance**~~

~~a. Facility evaluation. Care providers of existing facilities should evaluate their facility's ability to withstand the effects of regional natural disasters. The assessment should consider performance of structural and critical~~

~~nonstructural building systems and the likelihood of loss of externally supplied power, gas, water, and communications under such conditions.~~

~~b. Facility planning. Facility master planning should consider mitigation measures required to address conditions that may be hazardous to residents and conditions that may compromise the ability of the facility to fulfill care needs.~~

~~c. Seismic considerations. Particular attention should be paid to seismic considerations in areas where the seismic design classification of a building would fall into Seismic Design Category C, D, E, or F as described in ASCE/SEI 7: "Minimum Design Loads for Buildings and Other Structures."~~

1.2-4.5.3 Signage and Wayfinding

A1.2-4.5.3 Signage and wayfinding

…

d. Descriptive signage should be posted on the interior and exterior sides of entry doors with any special instructions for entry and exit during times of pandemic. Instructions should be provided in all languages commonly found in the resident, staff, and community population.

Chapter 2.1, Site Elements

…

***2.1-2.4 Access to Utilities**

A2.1-2.4 Availability of utilities in an emergency. The need for emergency and backup water supplies, emergency generators, and backup emergency power should be evaluated and addressed in the functional program. The need for additional generator capacity to supply additional HVAC systems and equipment, meal preparation and storage equipment, access control systems, and other systems and equipment should be evaluated as part of the facility's hazard vulnerability assessment with an eye toward possible extended usage beyond minimums mandated by other codes during emergency conditions.

2.1-3.6. Landscape Features

***2.1-3.6.1 General**

See Section 1.2-4.5.1 (Light) and Section 1.2-4.5.2 (Views of and Access to Nature) for additional requirements.

***2.1-3.6.2 Outdoor Activity Spaces.** Gardens and outdoor activity spaces shall be located to receive direct sunlight at some time during the day.

A2.1-3.6.2 Outdoor activity spaces. Facilities should provide outdoor spaces designed to promote outdoor activity on the part of residents, participants, and outpatients. Views of outdoor spaces from common dining, living, and activity rooms and from therapy areas can encourage users to go outdoors. Facilitating independent access to outdoor space, such as locating doors to outside space near resident rooms and providing automatic opening doors and flush thresholds will encourage residents to go outside without assistance. In new construction, building layout should consider providing direct outdoor access from each resident living area in each household or unit.

…

c. *Outdoor areas for visitation.* Consider providing an outdoor area easily accessible to the central interior common spaces of the building for the intended purpose of visitation during times of pandemic. The layout of this space should allow for proper social distancing measures and provide heating or shading to improve comfort.

Chapter 2.3, Design Elements

…

2.3-2.3.2 Lobby

2.3-2.3.2.1 General

(1) See the facility chapters in Parts 3 through 5 for additional requirements.

*(2) Shared lobbies shall be permitted in multi-occupancy buildings.

A2.3-2.3.2.1 (2) Where possible, staff should have a dedicated building entrance and exit that is physically separate from those accessed by residents, visitors, and other services. During infection events, space at the building entry should be provided for health screening per CDC recommendations. Design considerations should include the location and number of entrances and how access and circulation may need to be directed during emergency situations.

2.3-4.2.2 Medication Distribution and Storage Locations (Centralized and Decentralized)

2.3-4.2.2.1 General

(1) Provisions shall be made to support 24-hour distribution of medications.

*(2) A medication room, a self-contained medication distribution unit, medication storage in resident rooms, or other approaches acceptable to the authority having jurisdiction (AHJ) shall be permitted to be used for preparing, dispensing, and administering medications.

A2.3-4.2.2.1 (2) Provision of secured storage in each resident room is shown to reduce medication errors. In-room refrigerators to store refrigerated medications should be considered on a resident by resident basis.

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*2.3-4.2.10 Accommodations for Tele-Visits

A2.3-4.2.10 Tele-visit considerations. Facilities should encourage and facilitate alternative methods of communication with residents via video conference technology. During emergency conditions, there is potentially limited physical interaction with family, so tele-visit capability becomes important. Wireless technology and tablets can be used to provide this function to families via a variety of video conferencing apps and platforms.

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*2.3-4.3.2 Staff Lounge Area

A2.3-4.3.2 Staff lounge area. Provision of the following should be considered:

a. Access to views and outdoor space from the staff lounge area. See Section 1.2-4.5.2 (Views of and Access to Nature) for more information.

b. Furniture for relaxation and respite, especially in settings where staff are commonly scheduled to work extended and double shifts

c. A notification area to facilitate communication (e.g., human resources notices, resident passing, etc.)

d. Staff should have a dedicated outdoor space that is physically separate from those accessed by visitors and other services.

2.3-4.3.2.1 Staff lounge area(s) shall be permitted to be shared by more than one service.

***2.3-4.3.2.2** Staff lounge area(s) shall provide the following based upon the facility needs:

(1) Refrigerator

(2) Sink

(3) Space for microwave and other appliances

A2.3-4.3.2.2 Considerations should be made for long-term storage of food and other items for times when staff may be staying at the facility for an extended period.

***2.3-4.3.3 Staff Toilet Room**

~~**A2.3-4.3.3** Provision of shower facilities for staff should be considered.~~

…

2.3-4.3.5 Staff Shower

2.3-4.3.5.1 A shower and area to change clothes shall be provided for staff use.

2.3-4.3.5.2 This space shall be permitted to be shared with resident use space if approved by the AHJ.

2.3-4.7.2 Receiving Areas

2.3-4.7.2.1 Where provided, a loading dock and receiving and breakout area(s) shall be permitted to be shared with other services.

***2.3-4.7.2.2** Deliveries for the building shall be limited to one specific entry point/receiving area.

> **A2.3-4.7.2.2** During infection events, deliveries should be routed to a staging area for disinfection. Consideration should be given to the sorting and distribution of supplies to limit the number of trips required and thereby reduce exposure to staff and residents.

***2.3-4.8.1 Waste Collection and Storage Facilities**

Facilities shall be provided for sanitary storage of waste and recyclables per local requirements that are separate from food preparation, personal hygiene, and other clean functions. See Section 2.2-2.5.1 (Storage and Collection of Recyclables and Discarded Goods) for additional requirements.

> **A2.3-4.8.1** Safe containment of linens, towels, and clothing that may be contaminated from bodily fluids should be provided. During infectious disease events, trash collection in infected areas should be contained and separated from the remainder of the facility. Waste removed from an infected area should not pass through any other part of the building.

***2.3-4.10.6 Non-Refrigerated Body Holding Room**

A2.3-4.10.6 A non-refrigerated body holding room may be needed during times of pandemic or where immediate transfer of the body off-site is impractical.

2.3-4.10.6.1 Where provided, a non-refrigerated body holding room shall meet the following requirements:

(1) The non-refrigerated body holding room shall be individually temperature controlled.

(2) The non-refrigerated body holding room shall maintain a negative pressure to adjacent areas.

(3) The non-refrigerated body holding room shall be provided with a minimum total of 10 air changes per hour.

(4) The non-refrigerated body holding room shall maintain a design temperature of 70-75 degrees Fahrenheit (21-24 degrees Celsius).

2.3-4.10.6.2 All exhaust air from a non-refrigerated body holding room shall be discharged directly to the outdoors without mixing with air from any other room or exhaust system.

2.3-4.10.6.3 Air shall not be recirculated by means of a room unit.

Chapter 2.4, Design and Construction Requirements

…

***2.4-2.2.4.2 Door openings**

A2.4-2.2.4.2 Door openings. In-swinging, non-secured doors should have hands-free exit capability to enable room exiting without having to touch the door. This is particularly important for self-closing doors.

2.4-2.2.8.5 Provisions for drying hands. Provisions for hand drying shall be required at all hand-washing stations.

(1) Hand-washing stations shall include a hand-drying device that does not require hands to contact the dispenser.

(2) These provisions shall be enclosed to protect against dust or soil and to ensure single-unit dispensing.

*(3) Hot air dryers shall be permitted unless the care population dictates otherwise. See Section 2.2-4 (Design Criteria for Dementia, Mental Health, and Cognitive and Developmental Disability Facilities) for specific care population requirements.

> **A2.4-2.2.8.5 (3)** Hot air dryers should be circuited or provided with a shut-off so they can be temporarily disabled during an infectious disease event.

(4) Where provided, hand towels shall be directly accessible to sinks.

Chapter 2.5, Building Systems

…

2.5-2.3.2.3 Fittings

(1) The water discharge point of a hand-washing sink faucet shall be at least 8.5 inches (21.59 centimeters) above the bottom of the basin for resident rooms/bathrooms and 10 inches (25.4 centimeters) above the bottom of the basin for all other locations.

*(2) Hand-washing sinks used by care and nursing staff and food service staff shall have fittings—including single-lever or wrist blade devices that allow for hands-free operation.

(a) Blade handles used for this purpose shall be at least 4 inches (10.16 centimeters) in length.

(b) The location and arrangement of fittings shall provide the clearance required for operation of blade-type handles.

(c) Fixtures shall not be equipped with aerators but shall be permitted to have a non-aerating laminar flow device.

*(3) Sensor-regulated (electronic) faucets

(a) Sensor-regulated faucets shall meet user need for temperature and for length of time water flows.

(b) Electronic faucets shall be capable of functioning during loss of normal power.

(c) Sensor-regulated faucets with manual temperature control shall be permitted.

A2.5-2.3.2.3 (3) If sensor-regulated (electronic) faucets are provided, aerators and polyvinylchloride fittings should be avoided. Water flow and temperature should be controllable. Consideration should be given to providing programmed purge cycles to avoid the buildup of waterborne pathogens.

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*2.5-3.6 HVAC Filters

See the facility chapters in Parts 3 through 5 for requirements.

A2.5-3.6 Air handling systems should be designed to be capable of accommodating high-efficiency filters that exceed the required minimum.

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*2.5-5.1.2 Communications System Equipment Requirements

A2.5-5.1.2 Exterior communication connection. Where provisions are made for an exterior communication connection (wall or pedestal mount for network and telephone), consideration should be given to location of the box and the following:

a. In-conduit fiber and copper connections should be provided from the TER to the exterior communication box.

b. The exterior communication box should be IP67 exterior rated, UV resistant, operate in applicable temperature, and allow for quick connection to network and telephone service.

c. Power should be provided to the exterior communication box and separated from in-conduit communication lines.

2.5-5.6 Special Systems

*2.5-5.6.1 Real-Time Locating System

A2.5-5.6.1 Real-time locating system. Facilities should evaluate the need for real-time locating systems (RTLS) for resident and staff tracking to help with contact tracing.

a. Where provisions are made for RTLSs, consideration should be given to Wi-Fi network, technology for room level location (e.g., ultrasound, infrared, Bluetooth), and coverage area.

b. RTLS server equipment should be located in TER.

c. RTLS edge equipment should be located in TR.

2.5-9 Elevators

***2.5-9.1 General**

See the facility chapters in Parts 3 through 5 for requirements.

> **A2.5-9.1** When multiple elevators are included in the building design, consider dedicating one for staff and service that can be operated independently of resident and visitor use during an infectious disease event.

Chapter 3.1, Specific Requirements for Nursing Homes

…

***3.1-2.2 Resident Unit**

3.1-2.2.1 General

***3.1-2.2.1.1 Resident unit size.** See Section 3.1- 2.2.1.2 (Layout) for typical resident unit size in different types of nursing home models and appendix table A3.1-a (Nursing Home Care Model Characteristics) for additional information.

3.1-2.2.1.2 Layout

(1) In new construction, resident units shall be ~~arranged to avoid~~ designed to minimize unrelated travel through the units.

3.1-2.2.2 Resident Room

Each resident room shall meet the following requirements:

***3.1-2.2.2.1 Capacity**

(1) In new construction~~, maximum room capacity shall be two residents~~ the maximum number of residents per room shall be

one unless the necessity of a two-bed arrangement has been demonstrated. Two residents per room shall be permitted when approved by the authority having jurisdiction.

A3.1-2.2.2.1 ~~Single resident rooms with an individual toilet room are encouraged.~~ Evidence suggests that single-resident rooms decrease risks for medication errors, health care-acquired infections, resident anxiety, and incidents of aggressive behavior while improving resident sleep patterns and staff effectiveness. In two-bed rooms, consideration should be given to creating room configurations that maximize individual resident privacy, access to windows, and room controls and provide equivalent space for each resident (e.g., alcoves for each).

*(2) Where renovation work is undertaken and the present capacity is more than two residents, maximum room capacity after renovation shall be no more than two residence in accordance with CMS-3260-F, "Reform of Requirements for Long-Term Care Facilities."

A3.1-2.2.2.1 (2) On October 4, 2016, the Centers for Medicare & Medicaid Services (CMS) published a final rule on the "Reform of Requirements for Long-Term Care Facilities," CMS-3260-F, in the *Federal Register*. This rule revises the requirements that long-term care facilities must meet to participate in the Medicare and Medicaid reimbursement programs. Effective November 28, 2016, each resident room must have a maximum capacity of two residents and a dedicated bathroom with at least a toilet and sink. Look for guidance on room configurations to meet CMS requirements under the Resources tab on the FGI website.

(3) Companion rooms. A maximum of 10 percent of resident rooms shall be permitted to be companion rooms.

A3.1-2.2.2.1 (3) Companion rooms are primarily designed for a couple or siblings who prefer to continue to share living space. Consideration should be given to a layout that allows for flexibility so that either each person can have their own space, or half the room could be used as a sitting area while the other part accommodates both beds or one large bed.

3.1-2.2.2.2 Space requirements

…

* (3) Resident room accommodations. Accommodations provided for each resident room shall be accessible from a wheelchair or other resident-operated mobility device and include the following:

A3.1-2.2.2.2 (3) Consideration should be given to the provision of space to accommodate moveable furniture that allows for in-room dining.

(a) Window

(b) Bed

*(c) Resident chair or recliner

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*3.1-2.2.2.3 Window

(1) See Section 2.4-2.2.6 (Windows) in addition to the requirements in this section.

(2) In renovated construction, beds shall be no more than two deep from windows.

A3.1-2.2.2.3 Window. Operable windows to allow for direct fresh air exchange, especially during periods of high infection risk (e.g., coronavirus or influenza) should be considered.

***3.1-2.2.2.5 Hand-washing station.** A hand-washing station shall be provided in each resident room.

(1) Omission of this station shall be permitted in a single-bed or two-bed room where a hand-washing station is located in an adjoining toilet room that serves that room only.

(2) Design requirements

(a) For hand-washing station design details, see Section 2.4-2.2.8 (Hand-Washing Stations).

(b) For sink design, see Section 2.5-2.3.2 (Plumbing Fixtures—Hand-Washing Sinks).

(c) For casework details, see Section 2.4-2.4.2 (Casework, Millwork, and Built-Ins).

A3.1-2.2.2.5 In new construction and major renovation, accommodation should be made for either a temporary hand-washing station or a hand sanitation dispenser to be placed in a consistent location near the entrance to the bedroom without having to enter an adjoining toilet room. The temporary hand-washing station should include access to hot and cold water and water discharge, and space for a temporary hand-washing unit to be placed without limiting access/egress requirements for the bedroom.

***3.1-2.2.4.1 Airborne Infection Isolation (AII) room**

…

*(3) The toilet room provided for each AII room shall include a shower.

A3.1-2.2.4.1 (3) Where provided, a bedpan washing/disposal device should be provided in the AII room.

…

(6) Special Design Elements

(a) Architectural Details

(i) AII room perimeter walls, ceiling, and floor, including penetrations, shall be constructed to prevent air exfiltration.

(ii) AII rooms shall have self-closing devices on all room exit doors.

*(iii) Surfaces shall be smooth with minimal variations in joints, seams, perforations, or crevices.

A3.1-2.2.4.1 (6)(a)(iii) Surfaces with a large number of joints, seams, perforations, or crevices are difficult to clean and can harbor bacteria or other viruses. Resilient flooring is preferred for cleanability.

(iv) Ceilings

- Ceilings shall be cleanable with routine housekeeping equipment.
- Ceiling finishes shall be smooth and without crevices, scrubbable, non-absorptive, non-perforated, and capable of withstanding cleaning with chemicals.
- Acoustic and lay-in ceilings, where used, shall not create ledges or crevices.
- Where a lay-in ceiling is provided, it shall be gasketed or each ceiling tile shall weigh at least one pound per square foot.

- Use of perforated, tegular, serrated, or highly textured tiles shall not be permitted.

3.1-4.4.4 Visitation Room

3.1-4.4.4.1 General

(1) A room shall be provided for the purpose of facilitating safe visitation.

(2) This room shall be permitted to be used for purposes other than visitation outside of flu season or other infectious outbreaks.

3.1-4.4.4.2 Visitation room requirements

(1) Entry. There shall be a visitor entry and resident entry. The visitor entry shall be provided directly from the exterior or an adjacent entry vestibule.

(2) Layout. The layout of the space shall allow for physical distancing of 6 feet (1.8 meters) to be maintained at all times during visitation.

(3) Visitation zones. Each visitation room shall be divided into three distinct zones:

(a) Resident zone. The resident zone shall be located adjacent to the air return, which shall be supplied high above the resident zone.

(b) Neutral zone. The neutral zone shall provide a minimum 3-foot (91.44 centimeter) buffer between the resident and the visitor zones.

(c) Visitor zone. The visitor zone shall be adjacent to the air exhaust.

(4) Air flow shall be designed to direct air movement from clean at the resident zone to dirty where the air is exhausted outside.

(5) Pressurization

(a) The visitation room shall be designed to function under negative pressure.

(b) Temporary equipment shall be permitted to create negative pressure in the room.

*(6) Carbon dioxide. Each visitation room shall be equipped with a monitoring device. This can be achieved with a carbon dioxide (CO_2) monitor indicating continuous directional airflow and maintenance of negative space pressurization.

A3.1-4.4.4.2 (6) Carbon dioxide. CO_2 monitors can provide an indication of successful ventilation operations. Exhaled air is the vehicle for infectious particles and contains almost 40,000 parts per million (ppm) of CO_2, compared with approximately 350 ppm in outdoor air. Carbon dioxide may be considered a surrogate for exhaled breath. Thus, the infraction of inhaled air that has been previously exhaled by a person can be easily determined. Caution and visitation termination should occur if CO_2 levels in the room exceed 700 ppm.

(7) Surfaces. Room surfaces shall be able to withstand frequent sanitation and wipe down after each visit.

3.1-4.6.2 Laundry Facility

***3.1-4.6.2.2** Where linen is processed in a laundry facility in the nursing home, the following shall be provided:

A3.1-4.6.2.2 During infectious disease events, consider providing accommodation for a separate laundry facility

where affected soiled laundry can be managed and cleaned apart from the laundry for the remainder of the nursing home.

Chapter 3.2, Specific Requirements for Hospice Facilities

…

3.2-2.2.1.2 Layout

(1) In new construction, hospice units shall be ~~arranged to avoid~~ designed to minimize unrelated travel through the unit.

3.2-2.2.2 ~~Resident~~ Hospice Patient Room

Each ~~resident~~ hospice patient room shall meet the following requirements:

***3.2-2.2.2.1 Capacity.** ~~Maximum room capacity shall be one resident unless justified in the functional program and approved by the AHJ~~ The hospice patient room shall be single-occupancy unless the need for double-occupancy is justified in the functional program~~, in which case hospice patient room capacity shall not exceed two resident beds.~~

A3.2-2.2.2.1 Room size and capacity should include ~~Consideration should be given to~~ considerations for accommodating couples that may be ~~each~~ receiving hospice care either individually or at the same time.

***3.2-2.2.2.3 Window**

(1) See Section 2.4-2.2.6 (Windows) in addition to the requirements in this section.

(2) Provision shall be made for resident and family to completely darken the resident room.

A3.2-2.2.2.3 Window

a. Exterior windows should provide views to the natural environment and light where possible. Residents who are confined to their beds need a venue for visual stimulation. Plantings and other attempts to provide objects of visual interest should be made where exterior views of the natural environment are not possible due to existing building adjacencies. See Section 1.2-4.5.1 (Light) and Section 1.2-4.5.2 (Views of an Access to Nature) for additional information.

b. Operable windows should be considered to allow for direct fresh air exchange, especially during periods of high infection risk (e.g., coronavirus or influenza).

***3.2-2.2.2.5 Hand-washing station.** A hand-washing station shall be provided in each ~~resident~~ hospice patient room.

(1) Omission of this station shall be permitted in a single-bed or two-bed room where a hand-washing station is located in an adjoining toilet room that serves that room only.

(2) Design requirements

(a) For hand-washing station design details, see Section 2.4-2.2.8 (Hand-Washing Stations).

(b) For sink design, see Section 2.5-2.3.2 (Plumbing Fixtures—Hand-Washing Sinks).

(c) For casework details, see Section 2.4-2.4.2 (Casework, Millwork, and Built-Ins).

A3.2-2.2.2.5 In new construction and major renovation,

accommodation should be made for either a temporary hand-washing station or a hand sanitation dispenser to be placed in a consistent location near the entrance to the bedroom without having to enter an adjoining toilet room. The temporary hand-washing station should include access to hot and cold water and water discharge, and space for a temporary hand-washing unit to be placed without limiting access/egress requirements for the bedroom.

3.2-4.4.4 Visitation Room

A visitation room shall be provided that meets the requirements in Section 3.1-4.4.4 (Nursing Homes—Visitation Room).

3.2-4.6.2 Laundry Facility

*__3.2-4.6.2.2__ Where linen is processed in a laundry facility in the hospice facility, the following shall be provided:

A3.2-4.6.2.2 During infectious disease events, consider providing accommodation for a separate laundry facility where affected soiled laundry can be managed and cleaned apart from the laundry for the remainder of the hospice facility.

Chapter 4.1, Specific Requirements for Assisted Living Facilities

…

*__4.1-2.2.2.1 Capacity.__ ~~Bedrooms shall be limited to single or double occupancy.~~ The assisted living resident room shall be single-occupancy unless the need for double-occupancy is justified in the functional program.

A4.1-2.2.2.1 Room size and capacity should include consideration for accommodating couples or siblings that may be receiving hospice care either individually or at the same time.

***4.1-2.2.2.3 Windows**

A4.1-2.2.2.3 Windows. Operable windows should be considered to allow for direct fresh air exchange, especially during periods of high infection risk (e.g., coronavirus or influenza).

4.1-4.4.4 Visitation Room

A visitation room shall be provided that meets the requirements in Section 3.1-4.4.4 (Nursing Homes—Visitation Room).

4.1-4.6.3 Laundry Facility

4.1-4.6.3.1 General

(1) When on-site laundry services are provided, the requirements in this section shall apply.

*(2) Facilities for processing shall be permitted to be located in the facility or in a separate building.

A4.1-4.6.3.1 (2) During infectious disease events, consider providing accommodation for a separate laundry facility where affected soiled laundry can be managed and cleaned apart from the laundry for the remainder of the hospice facility.

Chapter 4.2, Specific Requirements for Independent Living Settings

…

4.2-4.4.3 Reserved

4.2-4.4.4 Visitation Room

A visitation room shall be provided that meets the requirements in Section 3.1-4.4.4 (Nursing Homes—Visitation Room).

Chapter 4.3, Specific Requirements for Long-Term Residential Substance Abuse Treatment Facilities

…

***4.3-2.2.2 Resident Room**

~~**A4.3-2.2.2 Resident room capacity.** Bedrooms should be limited to single or double occupancy.~~

4.3-2.2.2.1 ~~Reserved~~ Resident room capacity. The resident room shall be single-occupancy unless the need for double-occupancy is justified in the functional program.

***4.3-2.2.2.3 Windows**

A4.3-2.2.2.3 Window. Operable windows should be considered to allow for direct fresh air exchange, especially during periods of high infection risk (e.g., coronavirus or influenza).

***4.3-2.2.2.5 Hand-washing station.** Where a hand-washing station

is provided, see Section 2.4-2.2.8 (Hand-Washing Stations) for requirements.

A4.3-2.2.2.5 In new construction and major renovation, accommodation should be made for either a temporary hand-washing station or a hand sanitation dispenser to be placed in a consistent location near the entrance to the bedroom without having to enter an adjoining toilet room. The temporary hand-washing station should include access to hot and cold water and water discharge, and space for a temporary hand-washing unit to be placed without limiting access/egress requirements for the bedroom.

4.3-4.4.2 — 4.3-4.4.3 Reserved

4.3-4.4.4 Visitation Room

A visitation room shall be provided that meets the requirements in Section 3.1-4.4.4 (Nursing Homes—Visitation Room).

4.3-4.6 Laundry Facility

***4.3-4.6.1 General**

A4.3-4.6.1 Based on the care model, laundry services may be centralized in the facility, decentralized using personal laundry facilities, and/or outside contracted services. See Section 2.3-4.2.7 (Personal Laundry Facilities) for additional information. Completing laundry may be part of the resident's responsibilities, depending on the care population of the therapeutic community. During infectious disease events, consider providing accommodation for a separate laundry facility where affected soiled laundry can be managed and cleaned apart

from the laundry for the remainder of the substance abuse treatment facility.

Chapter 4.4, Specific Requirements for Settings for Individuals with Intellectual and/or Developmental Disabilities

…

4.4-4.4.4 Visitation Room

A visitation room shall be provided that meets the requirements in Section 3.1-4.4.4 (Nursing Homes—Visitation Room).

Appendices

Appendix 3-1: Case Study—Georgia Emergency Management and Homeland Security Agency (Immediate Short-Term Solution)

Early in the COVID-19 pandemic, southwest Georgia had one of the highest per capita rates of COVID-19 in the United States. As the pandemic threatened to overwhelm the area's health care system, the Georgia Emergency Management and Homeland Security Agency (GEMHSA) determined it needed to increase hospital capacity to accommodate the patient surge. To quickly increase the number of available patient rooms and assist the overburdened health care system, two modular hospitals were constructed from 42 shipping containers in Macon and Albany, Georgia.

Both hospitals, each with 24 patient rooms, were designed, constructed, and completed in only four weeks. To accommodate

the high level of care required for COVID-19 patients, the modular hospitals were designed with medical gas outlets, nurse call stations, and a dedicated HEPA-filtered outdoor air system that complies with most hospital regulations (the project team worked with the authority having jurisdiction to ensure safety was not compromised). The experience of the modular manufacturer contracted to do the work enabled the project to progress from concept to finished construction in one month, a remarkable feat that reduced pressure on hospitals in the region during a critical time.

Figure A3-1: Modules During Site Installation

Source: BMarko

Figure A3-2: Temporary Modular Hospital Designed for GEMHSA

Source: BMarko

Figure A3-3: GEMHSA Hospital Interior

Source: BMarko

- Because the project required a very aggressive schedule, daily—if not hourly—decision-making was essential to keep costs low. Key decisions included:
  - Identifying essential medical requirements
  - Determining equipment power requirements

- Preliminary architectural and permit phases were, in effect, eliminated. As a result:
  - Aesthetics were de-emphasized.
  - Essential life safety provisions were determined with the AHJ.
  - Submittals were reviewed while the structures were being built.
- To meet the schedule, work on converting the shipping containers started well before final approvals were in hand, severely limiting any changes to the design during production.
- Sitework started before all the requirements (e.g., egress) were known. Specifications for sidewalks and ramps to finished floor heights had to be established during building installation.

Project Specifications

When health and residential care facilities have an urgent need, modular solutions can provide quick, effective, and safe results. Although they may not meet all requirements for permanent structures, they can provide timely relief that is far superior to tents and some other types of alternate care sites.

Appendix 3-2: Case Study—St. Croix Health Center (Intermediate Solution)

In September 2017, Category 5 Hurricane Maria devastated the U.S. Virgin Islands (USVI). In the aftermath of the storm, the Charles Harwood Hospital on the island of St. Croix was condemned. The Federal Emergency Management Agency (FEMA) requested help from the U.S. Army Corps of Engineers (USACE) to solicit a turnkey solution to the immediate need for a health care facility. The end goal was to provide an economical and expedited solution for the USVI Department of Health to meet all of their obligations to the public while a permanent health care facility was designed and constructed.

A Maryland-based modular company responded by evaluating the project's requirements and generating floor plans for each division of a modular health care complex. Because there were no adequate water sources for the complex's sprinkler system, the manufacturer organized different medical divisions into separate buildings that were far enough apart to achieve the distances required between structures to eliminate the sprinkler requirement. A walkway system connected all of the buildings that comprised the overall modular health care complex.

Project Specifications

The resulting complex consisted of 66 modules totaling 40,000 square feet. Electrical connection was supplied by a 750 kilovolt-ampere transformer and an emergency generator. A 3,000-gallon emergency fuel tank was supplied for the generator. The complex also included a 450-foot retaining wall and parking spaces that were compliant with the Americans with Disabilities Act.

Figure A3-4: Modular Structures in St. Croix Built to Serve for an Intermediate Period

Source: Modular Genius

Figure A3-5: Interior of Modular Building

Source: Modular Genius

Lessons Learned

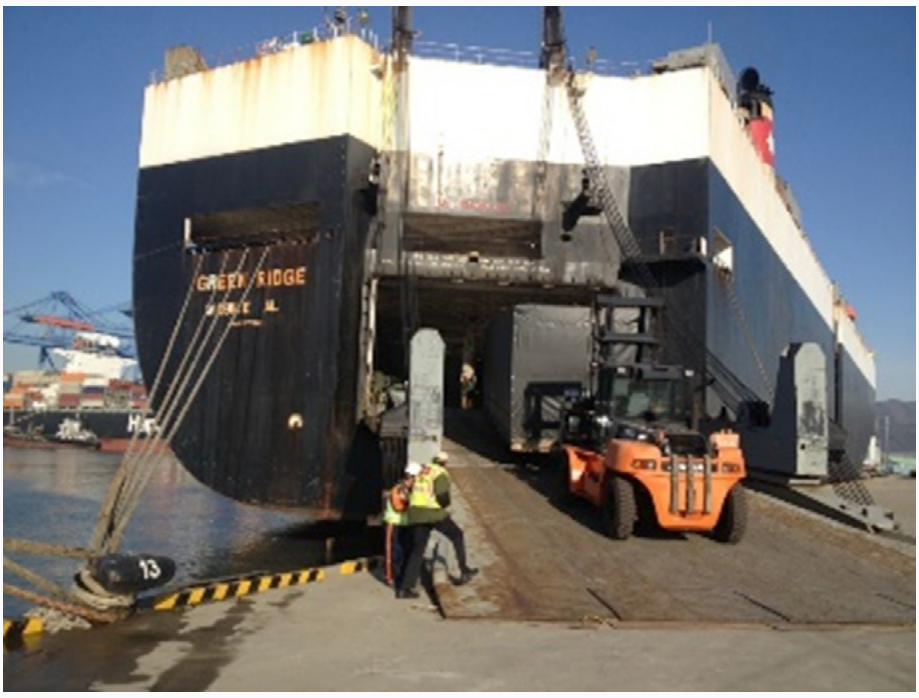
Beware of unexpected extended durations in remote areas

FEMA engaged USACE to ensure the project followed code requirements. Due to significant time constraints, this 40,000-square-foot facility was designed from eight pages of very vague specifications. The scope of work entailed 120 days for initial design and on-site activation of the facility. Despite this, government delays and added scopes of work caused the project duration to exceed 18 months. This extended timeframe forced the modular manufacturer to utilize project managers and other resources much longer than anticipated.

Be aware of shipping requirements and have the appropriate credit needed for unforeseen circumstances

These buildings were constructed in Georgia before being shipped to St. Croix on a roll-on/roll-off vessel. Because this modular

Figure A3-6: Roll-On, Roll-Off Shipping Vessel



Source: Modular Genius

facility was under the purview of USACE, it was considered a Department of Defense project. The Military Cargo Preference Act of 1904 requires that all cargoes "bought for the Army, Navy, Air Force, or Marine Corps" be shipped aboard U.S. flag ships. Because this provision was not detailed in the project's specifications, the manufacturer worked with smaller, non-U.S. flag ships that were capable of delivering shipments only intermittently instead of all at once. Due to the breach in protocol, the U.S. Maritime Administration held up the project for six months until a resolution was established. The manufacturer was unable to invoice USACE for the buildings during this six-month delay.

Beware of entities that stand between you and the end user.

The end user (USVI Department of Health) made many requests beyond the scope of work as this project unfolded, but USACE was unable to diverge from the original scope of work until any modifications were formally detailed in writing. Thus, satisfying the end user was difficult due to USACE's change order process, and a considerable amount of time was wasted because desired modifications to the design couldn't be made until formal documentation had been completed.

Consider that local labor forces may deviate from expected levels of quality

Although the modular manufacturer sent labor from the United States, local trades were also used. Having no established working relationship with the local subcontractors proved challenging, especially considering the project's need for expediency. Even when local experts were consulted, meeting USACE quality standards proved difficult.

Be prepared for unexpected site conditions, especially in unfamiliar areas

Although this project was deemed temporary from its inception, it became evident the end user intended to keep the buildings on-site for an extended period (at least 5 years). For this reason,

the modular manufacturer asked to take geotechnical borings, but USACE advised to assume a 2,500-psi soil bearing. Because the project's specifications were initially created around a temporary timeframe, USACE did not permit a formal modification to conduct a geotechnical report. Once grading and trenching was completed, soil issues (groundwater, soft soil, rock) became apparent. The project thus incurred additional delays that could have been avoided.

Appendix 3-3: Case Study—Coney Island Health Center (Long-Term Modular)

This case study focuses on the Ida G. Israel Health Center, which aimed to replace a Brooklyn, New York, health care facility that was destroyed during Hurricane Sandy in 2012. Project requirements specified the replacement facility needed to be located in the same neighborhood as the original clinic while also being close to Brooklyn's Coney Island Hospital. A second objective was to have the replacement facility up and running as quickly as possible.

Figure A3-6: Ida G. Israel Health Center, Coney Island

Source: Axis Construction Co.

Figure A3-7: Long-Term Replacement Clinic

Source: Axis Construction Co.

Solution

Given this project's strict time constraints, off-site construction was employed to facilitate shorter on-site installation time. All of the modules that would comprise the new facility were built at the same time. This approach also helped designers ensure that precise fits and finishes were in place before the modular units were deconstructed and transported from the manufacturing plant. The resulting health care structure incorporated dental, behavioral health, and substance abuse clinics, all meeting New York City building codes, New York State Department of Health regulations, and FGI *Guidelines* requirements. Project managers also maintained strict adherence to budget requirements as the overall effort was funded by the Federal Emergency Management Agency.

Figure A3-8: Modular Interior

Source: Axis Construction Co.

Lessons Learned

Following is a brief list of takeaways derived from this project. It should be noted that these concepts could be broadly applied to any modular construction project.

Collaborative approach. The entire project team involved should be equally committed to the concepts and end goals of the project.

Timing is everything. Careful attention should be given to the phasing or sequencing of a project, beginning with the initial design process all the way through to construction and installation. Turnaround time for approvals is generally shorter compared to the time needed for approval of projects produced using traditional project delivery methods.

Scope of work responsibility matrix. The scope of work agreed to for a given project should identify different stakeholder responsibilities and provide a detailed outline of the work needed. A scope-of-work responsibility matrix can be used to help clearly define and reference stakeholder responsibilities while a project is being executed.

Subcontractor selection. When subcontractors familiar with a project's off-site processes are unavailable, the subcontractors hired should be educated about off-site construction methodology.

Site logistics and mobilization. All transportation needs should be carefully planned, and a staging area established. Use of cranes and other heavy equipment should be coordinated in conjunction with the crane lift plan.

Receiving, installing, and finishing the modular building. When preparing for the deployment process, take time to determine what permits or approvals at local and state levels will be necessary. Permit issuance requires a project review and approval process so make sure to plan this into the project schedule.

Scheduling of trades. Consider stacking trades as well as the client's expectations.

Site completion. Immediately after the building is set (e.g., placed on the site's supporting foundations), the building envelope must be finalized. Complete exterior cladding (waterproofing) between sections and conduct final walk-through and turnover processes. Finish the project with commissioning and contract closeout.

Appendix 3-4: Case Study—Coliseo Juan Aubin Cruz Abreu, Manati, Puerto Rico

Hurricane Maria struck Puerto Rico as a Category 5 storm in September 2017. Winds topped out at 175 miles per hour, devastating the island and causing nearly 3,000 fatalities. This took place only two weeks after Hurricane Irma had struck the island, which meant that more than 80,000 residents were still without power when Maria arrived. The second hurricane completely destroyed the island's power grid, left 44 percent of the population without water, and eliminated 95 percent of the island's network connections. One week after Maria, only 11 of 69 hospitals were receiving electricity from generators.

The immediate medical response came from the Federal Emergency Management Agency Disaster Medical Assist Teams based in Florida, which were on the ground in Puerto Rico within 48 hours. They began

Figure A3-9: Arena Used to Provide Health Care

Source: Battalion Chief Juan Atan, Firefighter/Paramedic, Orange County Fire Rescue

by identifying alternate care sites that could serve local communities throughout the island. Roads were impassable, so most patients traveled by foot. Within 72 hours, the Coliseo Juan Aubin Cruz Abreu basketball arena in Manati, a community about an hour and a half outside of San Juan, was taking in patients while operating at a basic level of efficiency.

Short-Term (Immediate) Actions

Upon arrival, medical teams found no electrical service to the facility, no backup generators, and no water service. Note that the immediate need for caregiver safety necessitates prompt deployment of very rudimentary care stations equipped with small portable generators. Larger generators were flown in within 48 hours,

Figure A3-10: Patient Care Areas Inside the Arena

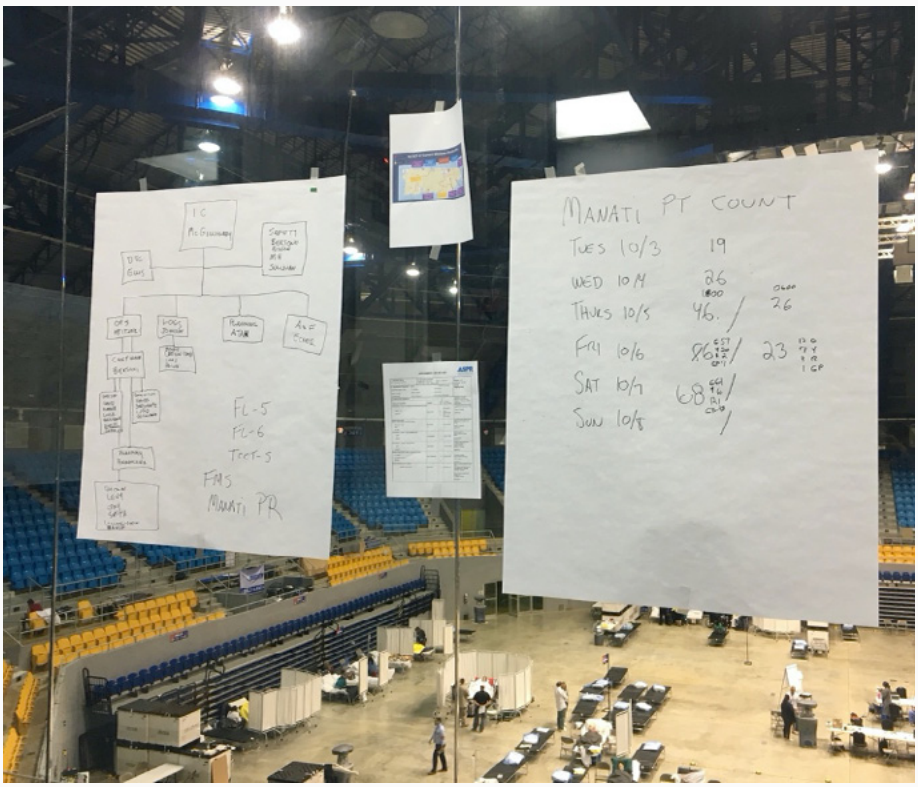
Source: Battalion Chief Juan Atan, Firefighter/Paramedic, Orange County Fire Rescue

and a local fire department tanker truck was commandeered to provide some basic water supply, but it was not possible to provide functioning toilets. Tents were set up inside the arena for provision of immediate emergency patient care. Tent roofs were left uncovered because the arena's overhead lights were able to support patient care processes once generators were activated. Fire safety sprinklers were not a consideration due to the absence of the water and electrical services required to operate the system's pumps.

Temporary Actions

Primary public access was routed through the front door of the arena, while the ambulance entrance was in the rear. No loading docks or refrigeration spaces were available. There also were no on-site mortuary accommodations, but fortunately this care site did

Figure A3-11: Managing the Alternate Care Site



Source: Battalion Chief Juan Atan, Firefighter/Paramedic, Orange County Fire Rescue

not incur any patient fatalities. Patients who were in very critical condition were stabilized and flown to a large facility in San Juan. Once the local "walking wounded" and patients requiring longer care due to other conditions (i.e., the regular patients a hospital would see under normal conditions) started coming in, additional areas were established throughout the arena using the standard triage categories of green, yellow, and red. An additional triage category "GP" was used for general population patients as defined above.

Crucial Early Staging of Basic Medical Supplies

This alternate care site saw nearly 5,000 patients while operating for more than 90 days. The caregivers worked through harsh conditions, including communal bunking on cots, limited sanitation for weeks (until the water supply was reestablished), and limited access to food and medical supplies. Oxygen was strictly rationed, with priority given to the sickest among the patient population.

One chief nursing officer and one chief planning officer interviewed for this case study suggested that staging of basic medical supplies, including oxygen, in advance of an emergency event would be a huge step forward when responding to future events across the United States. It is not uncommon for personnel to arrive on-site before necessary supplies have been delivered, which can quickly cause an inefficient and frustrating situation for all parties involved.

Appendix 3-5: Case Study—Converting Hotels to Hospitals

In the early stages of the COVID-19 pandemic, projections for the number of hospital beds that would be needed were overwhelming. In response, health care organizations, regulatory authorities, and designers were all eager to find quick and achievable solutions for converting non-health care spaces into temporary health care sites. A widely publicized solution during these early stages was the conversion of hotels into hospital rooms. Architecture firm HKS published an in-depth concept study on this topic in March 2020, titled "COVID-19 Conversions: Hotels to Hospitals."

Taken at face value, the idea of converting a hotel to an alternate care site was very logical: hotels already offered beds in private rooms with private bathrooms—and they were largely empty due to travel restrictions and stay-at-home orders. However, in reality, converting hotels to support patient care was costly and time-consuming and ultimately didn't prove to be an ideal solution. However, hotels can still provide a practical solution for low-acuity, ambulatory patients who need minimal monitoring without all of the resources offered through established hospitals.

The Challenges of Hotel Conversion

The HKS study identifies the following drawbacks to converting a hotel for use as a patient care facility:

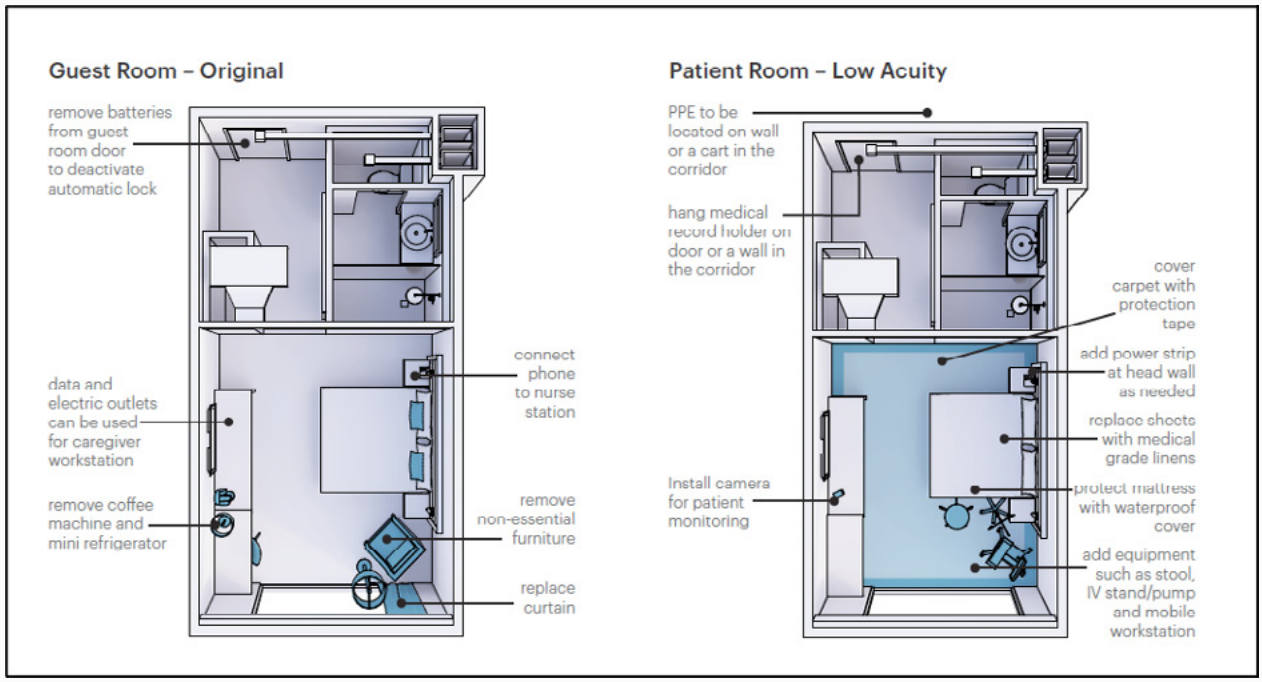
- Hotels are not appropriate alternate care sites for certain populations, including pediatric and geriatric patients, patients requiring a ventilator or relying on machine-assisted breathing, or those who require monitoring due to risk of progression to a severe condition.
- Different space use scenarios that could be employed during an emergency (e.g., using hotel rooms as patient rooms and creating a "ward" in the ballroom each presents challenges, not the least of which are suboptimal air exchange rates, surfaces

unsuitable for health care use, and a lack of readily available support spaces.

Because of these difficulties, few hotel conversion projects were been completed or even made it beyond a very basic planning phase. The most accessible examples of such conversions were deployed in China, Spain, and India. In June 2020, the *Guardian* reported that the Delhi government planned to convert 25 luxury hotels into temporary health care facilities. As reported in the article:

> Much work lies ahead to get the hotels fully operational. Hotel elevators are not big enough to take stretchers or gurneys. Air-conditioning systems have to be adapted. Halls that are carpeted for acoustic reasons will need to be stripped. Rooms are not equipped for oxygen, monitoring machines, or call bells. Extreme sanitation protocols will have to be put in place in every single area. Systems are needed for the disposal of biomedical waste.

Figure A3-12: Adjustments to Room Features



Source: HKS

Because there was a great deal of staff trepidation (hotel staff, too, were being repurposed to provide care to patients), the Indian government's plan was to link each hotel with the nearest hospital. The hospital, in turn, identified and assigned medical teams to work at each hotel. With projections that 150,000 hospital beds would be needed in the capital alone, converting 25 hotels to health care spaces provided an imperfect response for an imperfect situation. It provided protection from the elements, but few would argue that the quality of care did not suffer.

Lessons Learned

Despite the many challenges in converting hotels into alternate care sites, the extraordinary circumstances of the COVID-19 pandemic necessitated creative solutions that would not usually meet health care standards. Where possible, any prospective alternate care site should be identified, analyzed, and reviewed by the appropriate regulatory authority prior to a public health emergency.

Common challenges

The following challenges are common when attempting to use hotels as alternate care sites:

- Hotel beds are ill-suited for health care use.
- Ventilation in hotels may not have the necessary outside air changes for health care occupancies, particularly during an infectious disease event such as the COVID-19 pandemic.
- Hotel surfaces (e.g., carpeted floors) do not support infection prevention best practices.
- Corridor widths, door openings, and elevators may not be sized to accommodate needed equipment such as gurneys and PPE carts.
- Hotel rooms may not have adequate clearances to support patient monitoring equipment.

Solutions

These solutions may help address the challenges listed above:

- Fully cover hotel mattresses with a waterproof protective wrap.
- Increase air exchange rates, upgrade HVAC cleaning protocols, and install HEPA filters.
- Remove carpets or use a "carpet protection tape" to create a barrier between the carpet and the patient that can be changed between patients.
- Limit occupancy to ambulatory, low-acuity patients. Non-ambulatory patients should be routed to the nearest hospital.
- Remove all extraneous hotel items (e.g., armchairs, refrigerators, desk chairs) to increase clearances around the bed.

Best uses

It can be argued that repurposed hotels are best utilized only during certain surge conditions, such as an emergency that does not include airborne transmission of disease. However, hotels may be an ideal solution in health emergency situations that are expected to be short-term and without a transmissible element (e.g., extreme heat or cold conditions).

Resources

Dhillon, A. "Delhi to Transform 25 Luxury Hotels into COVID-19 Care Centres." *The Guardian*. June 21, 2020. https://www.theguardian.com/global-development/2020/jun/22/delhi-to-transform-25-luxury-hotels-into-covid-19-care-centres.

HKS. "COVID-19 Conversions: Hotels to Hospitals." Accessed January 19, 2021. https://www.hksinc.com/how-we-think/research/covid-19-conversions-facility-transformation-to-alleviate-overburdened-health-systems/.

Appendix 3-6: Case Study—McCormick Place, Chicago

In an effort to offset an anticipated surge of COVID-19 cases during the spring of 2020, city and state officials partnered with building owners, design specialists, and local health care practitioners to rapidly convert Chicago's McCormick Place convention center into an alternate care site for low-to-moderate acuity COVID-positive patients. The project's design team developed a plan for creating, installing, and outfitting 3,000 patient cubicles, all scheduled for completion within a 25-day period. Given the time constraints of this project, prior planning was minimal.

Materials and Methods

All products used for this project were readily available, off-the-shelf items with the exception of the COVID-19 isolation pods, which were custom built and delivered to the site. Products used for finishes included vinyl composite tile, vinyl-covered gypsum, stick-built cubicles with vinyl panels, LED lighting, hospital-grade electrical devices, and prefabricated headwall assemblies. The exhibition hall's HVAC system was altered to create negative pressure. Scaffolding assemblies were used to laterally route medical gas systems, electrical wiring, HVAC trunk lines, and other routing lines around the patient cubicles. Large fans were used to exhaust the air to the outside.

Three halls were used for this project, with a total capacity for 3,000 patients in approximately 1,475,000 square feet. The space was designed, built, and operational 25 days after the initial notice to proceed (which included a schedule overlap for Halls A and B).

The 837,337-square-foot Hall A accommodated 1,750 low-acuity, COVID-negative patients and was designed, built, and operational in seven days.

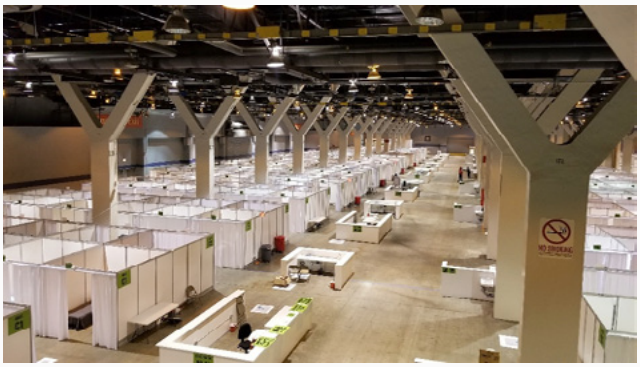
Figure A3-13: McCormick Place Hall A

Source: Douglas J. King

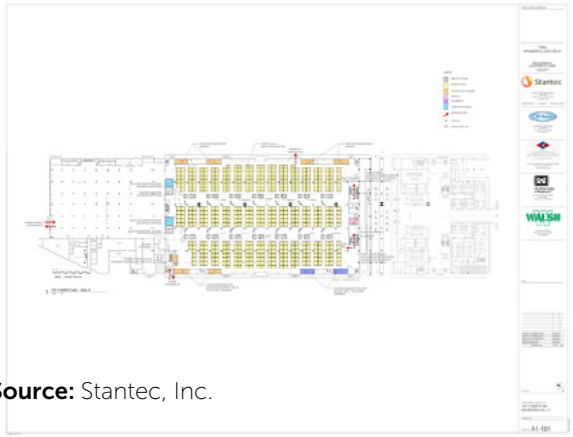
Source: Stantec, Inc.

The 144,204-square-foot Hall C accommodated 500 low-acuity, COVID-negative patients and was designed, built, and installed in five days.

Figure A3-14: McCormick Place Hall C



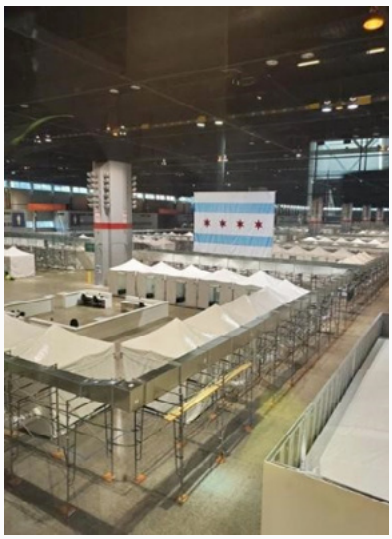
Source: Douglas J. King



Source: Stantec, Inc.

The 503,000-square-foot Hall B accommodated 750 acute care COVID-19 patients, including 15 ventilator patients. It was designed, built, and operational in 21 days.

Figure A3-16: McCormick Place Hall B



Source: Douglas J. King

Source: Stantec, Inc.

Lessons Learned

The general takeaways from the McCormick Place conversion can be broadly applied to any project that is similar in scale or scope. The McCormick Place challenges are specific to this project but may also be of value when considering other types of alternate care sites.

General lessons and takeaways

Need for safety. Have entities that are tasked with monitoring safety on-site; this includes ensuring care and food provisions for staff members.

Speed. Under strict time constraints, emphasis should be placed on rapid decision-making during design, construction, and installation. In this timeframe, "perfection is the enemy of done."

Adaptability. Engage ingenuity to invent solutions with products and processes that are readily available.

Collegiality/peripheral vision. Maintain an "attitude of inclusiveness" and a focus on mission-oriented problem-solving. This can be aided by developing a familiarity with the space that is being adapted.

Balanced needs. Balance all clinical needs with the infrastructure's ability to be adapted.

Operational planning and design. Develop operational planning in tandem with the alternate care site's design, ideally prior to the required emergency response. Try to have designs, operational procedures, and responsible parties identified in advance of an emergency event.

McCormick Place challenges

Planning under strict time constraints. Stakeholders involved with the McCormick Place project faced a large task with little time for completion. There was no time for conventional design drawing and layout approvals during this project. Accordingly, all involved parties endeavored to work as quickly as possible, and the first 500 beds were installed and operational within five days. However, it is recommended that any alternate care site be audited early to assess the site's capabilities as soon as possible.

Preventing delays related to custom components. Where on-site components will require customization for an emergency response application, predetermination of vendors offering these components is paramount to ensuring a quick installation process. Having draft agreements in place for these kinds of transactions would save additional time during the procurement process.

Providing HVAC, medical gas, and electrical solutions. HVAC, medical gas, and electrical components may require anywhere from one to two weeks for delivery and installation in most cases. An ideal solution would be storing necessary HVAC, medical gas, and electrical components in a predetermined area intended for storage

of regional emergency supplies. Note that if only a small amount of medical gas is needed for a project, it could be locally provided via tanks; however, situations that call for larger quantities (such as treatment for COVID-19) will likely require custom installation of medical gas systems.

Planning alternate care site layouts. Electronically documented design layouts for alternate care site plans should be completed to the fullest extent possible prior an emergency event. Having these plans in place ahead of time will significantly reduce complications that can arise when designs are created close to or during installation. Plans for alternate care site layouts could also be reviewed in advance by the authorities having jurisdiction, facilitating creation of a care site that is as code compliant as possible.

Appendix 3-7: Case Study—SUNY Stony Brook University Hospital

This case study examines how an alternate care site was deployed on the campus of the State University of New York (SUNY) at Stony Brook in response to a statewide surge in COVID-19 cases during the spring of 2020. The client was the U.S. Army Corps of Engineers (USACE), which contracted with four private firms for the design and construction process. The purpose of the project was to absorb patient overflow from the university's hospital as needed.

The alternate care site consisted of office and fabrication areas in an indoor basketball arena and five outdoor tents, contributing more than 1,000 beds intended initially for the care of ambulatory, COVID-negative patients. The project's overall design and timeframe underwent a series of unplanned changes during its first two weeks, and project managers faced a number of additional challenges in the form of location constraints, adverse weather events, code compliance issues, and on-site communication issues. In this case, adaptability and rapid response to unforeseen complications were paramount to achieving a functional alternate care site.

Care Site Attributes

The tents (two large and three small tents) featured individual pods with ridge walls that were fabricated off-site. Each pod measured 10 feet by 10 feet with a five-foot-wide entrance, and was open on top to the overarching tent ceiling. A central power pole supplied electrical connections, data transmission, and nurse call capabilities to each bed. Toilets and showers were provided via modular units. The nurse station and clinical support area consisted of conventional stick-built construction with a fire-rated ceiling. A fire alarm system and full sprinkler system were installed. HVAC was provided at the perimeter of each tent. Generators provided both normal and emergency power during the first day of site activation, but cables

were eventually installed to provide normal power via connection to the grid. Bottled oxygen was provided for medical use.

Changing Situation During the First Two Weeks

Below are brief summaries of significant changes to the project's design that took place during the first two weeks of site activation.

Day one

Initially, patient care was divided between the university's basketball arena and the outdoor tents, which were proposed to be located on the grounds of the university's football stadium. The team was told the arena would house 78 ambulatory, COVID-negative patients, and 960 ambulatory COVID-negative patients would receive care in the outdoor tents.

Day two

University staff expressed concerns about the possibility of patients remaining on campus in the fall, and thus the plans for construction were modified. The construction team was allowed to use the indoor basketball arena as a large field office, however the football field was no longer available as tent space. In response, all five tents were constructed on the flattest possible areas of the campus, with four on the grounds of an intramural sports field and one in a parking lot.

Week two

The construction team was told to design one tent for 20 COVID-positive patients. This required understanding how the mechanical, engineering, and plumbing (MEP) features would need to be upgraded. Later in the week, the construction team was told that the two larger tents should be prepared as care sites for an influx of COVID-positive patients, and thus donning and doffing areas were created inside the tents while oxygen storage capabilities were significantly increased outside the tents.

Other Project Challenges

The following challenges arose during the site's design and construction.

Location constraints

Site planners initially intended to use four large tents rather than two large tents and three smaller tents. However, the layout of the university's available outdoor space and the requirement to preserve access between them and to fire roads meant there was not enough space for four large tents. An attempt was made to add additional doors near support spaces in the tents to ease restocking of supplies and removal of dirty items, but spatial constraints prevented this as well. There were also on-site grading concerns, and regrading was not possible given the project's time constraints. One low spot in particular raised concern among the construction team, and when heavy rain began during site construction, it was clear the concerns were justified. Eventually, barriers were set up to divert further rainfall.

Limited input and guidance

This project began during a period of heightened COVID-19 infection rates across New York state, and thus clinical input was very limited compared to typical health care projects; the hospital was simply too busy to spare staff to participate in project planning. Because USACE guidelines only applied to the design and operation of a generic field hospital, that document could only serve as a starting point for guidance toward proper compliance. As a result, the design team had to be advocates for the patients and clinical staff using the site. The design team researched health care codes and best practices and made decisions on what could and could not be compromised in real-time. For example, the size of the tents raised concerns about travel distances because placing two of the large tents side-by-side created a distance that was longer than a football field. This forced the designers to carefully consider the location of shared resources and nursing stations as well as the relative importance of certain resources.

Time constraints

This alternate care site was both designed and constructed at a very fast speed. Reoccurring inclement weather added an entire week to the program's initial plans. Nonetheless, construction took place around the clock, with very little time for effective on-site coordination. Design decisions were made quickly, and there were no opportunities to redo work.

Lessons Learned

Remain aware of materials needed and delivery times. The procurement of necessary materials (ranging from table surfaces to portable toilet units to MEP components) became the controlling factor for the whole project; the construction team had to continuously assess how much material was needed while considering how long it would take to arrive on-site.

Consider using construction pipe scaffolding. Use of construction pipe scaffolding was invaluable during this project. It supported both fire suppression piping and HVAC systems on the outside of the tents and could also have been used to support the HVAC system for the clinical support area.

Determine the exact site locations and zones for patient care spaces early on. Tent perimeter real estate was very rare and valuable during this project. Ambulance entrances, life safety egress, access to toilets/showers, HVAC systems, power supplies, and fire protection systems were all competing for the same space. Determining specified zones as early as possible will make it easier to balance competing needs.

Anticipate difficulties with dimensional compliance. Even though the project designers were granted relief from some codes (e.g., corridor width), a significant effort was made to provide eight-foot corridors to support safe patient transportation and degrees of social distancing. However, the rapid pace of construction throughout the project resulted in some corridors being smaller than eight feet. It

may be worthwhile for designers to assume that dimensional issues will be encountered during similar projects.

Take advantage of prefabrication and off-site fabrication as much as possible. This option was available to the designers working on this project due to the relatively convenient location of the university and the nature of the emergency being addressed. The designers were able to provide electrical power, data transmission, and nurse call capabilities to each bed by using a power pole fabricated off-site by an electrical contractor at the same time the initial on-site construction was taking place. This two-pronged approach allows for completion of multiple objectives simultaneously.

Consider the use of tent structures carefully. Despite their relatively easy deployment and removal, in many cases tents might best be considered a "last resort" solution. A significant amount of additional infrastructure was required to make the tent structures useful during this project. Tents can also present complications during adverse weather events.

Conclusion

Due to the significant drop-off in COVID-19 cases that occurred after construction was finalized, this alternate care site was never used to treat any COVID-positive or negative patients.

Appendix 4-1: Case Study—Superstorm Sandy, Catalyst for a Hazard Mitigation Assessment

In October 2012, Hurricane Sandy (often referred to as Superstorm Sandy) devastated New York City with winds that exceeded 75 miles per hour. The storm's strength and angle of approach, combined with a full moon phase, resulted in tides 20 percent higher than normal. The water surge on Manhattan's southern tip at Battery Park topped 13.9 feet, surpassing the 10-foot record that was set in 1960. Tides overwhelmed Lower Manhattan's seawalls and flooded low-lying streets, sending local hospital systems scrambling for higher ground.

As noted in the 2013 PlaNYC report "A Stronger, More Resilient New York," five acute care hospitals and one psychiatric hospital had to close during the storm. According to the report:

> …this resulted in the emergency evacuation of nearly 2,000 patients, coordinated by the Healthcare Facility Evacuation Center, in addition to an unknown number of patients who were transferred within provider networks or discharged before or after Sandy. Of these, three hospitals closed in advance of the storm: New York Downtown (Manhattan) closed after notice of a potential pre-emptive utility shutdown, while the Veterans Affairs New York Harbor Hospital (Manhattan) and South Beach Psychiatric Center (Staten Island) closed due to concerns about flooding. Three other hospitals—New York University Langone Medical Center (Manhattan), Bellevue Hospital (Manhattan), and Coney Island Hospital (Brooklyn)—evacuated during or after Sandy due to the failure of multiple electrical and mechanical systems including emergency power systems.

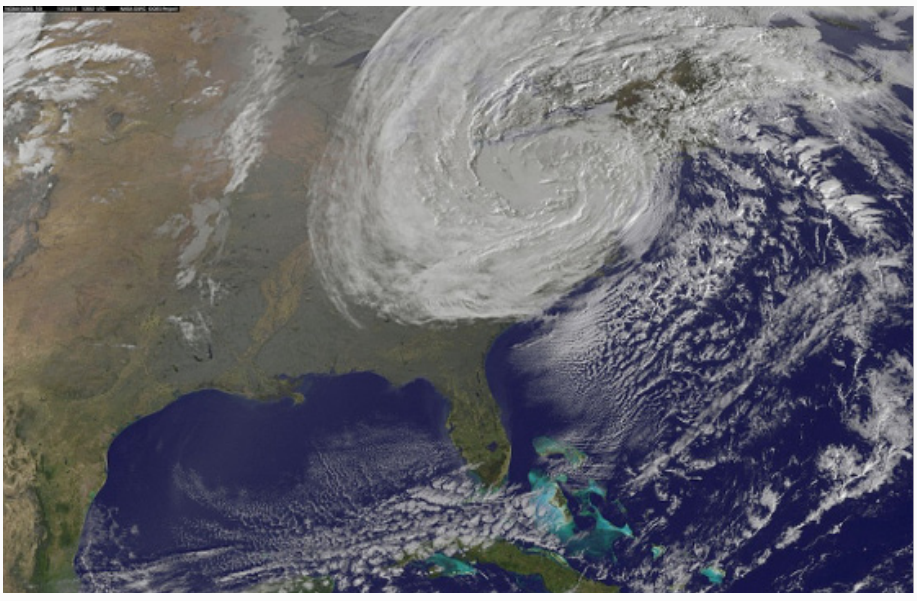
Identifying Hazards

A hazard mitigation assessment program (HMAP) is a proactive

process to identify opportunities to harden facilities in advance of an event rather than reacting to needs as they arise during and after an event. This approach does not address remediation, reactionary, or operational processes that would occur during or immediately following a given event.

In the aftermath of Hurricane Sandy, one health care organization severely affected by the storm initiated an HMAP to ensure the organization would be better prepared for the next event. To form a complete model of the institution, the services of hospital design firms and construction managers were retained to assist in developing feasibility studies, recommendations, and cost estimates. Participating clinical and operational team members provided direct input to the HMAP process using the organization's existing hazard vulnerability assessment process, questionnaires, and off-site retreats. The HMAP process allowed the health care organization to look beyond the hurricane and identify preventive measures that could keep critical hospital systems operational during any potential emergency events (e.g., a major power outage or extended period of extreme temperatures.)

Figure A4-1: Superstorm Sandy from the GOES-13 Satellite, October 2012



Source: National Oceanic and Atmospheric Administration, 2012

The year after Hurricane Sandy, several New York health care organizations and government agencies developed and published a variety of proposed building code changes and recommended best practices. (Reports from these local organizations and agencies are included in the resources section of the chapter on resiliency in this white paper.) The health care organization's HMAP team reviewed these documents and used the findings to develop organization-specific recommendations that reduce potential hazards.

The HMAP team identified threats to the organization's infrastructure systems and determined mitigations for those hazards. These recommendations were presented for each of the organization's campuses; Table A4-1 depicts the top-tier hazards identified for each campus during the HMAP process.

Table A4-1: Hazard Mitigation Assessment Program Top-Tier Hazards by Campus

Campus	Flood	Fire	Loss of Normal Utility Power	High Wind	Extreme Temperatures/ HVAC Failure	Fuel Oil
A	X	X		X		X
B	X	X	X		X	
C	X	X	X	X		
D	X		X	X	X	

Generating Mitigation Strategies

Mitigation strategies will be unique to each health care facility and each identified critical event. Nonetheless, planned mitigation strategies can provide a layer of protection. These strategies are not designed to be comprehensive, but they are likely to be interwoven across events so that one solution for a hurricane is also appropriate for flood mitigation. Following are brief explanations of the "top-tier hazards" identified by the New York City health care organization's HMAP team, along with recommended solutions.

Flooding. Floods may occur inside and outside buildings. Internal flooding is a risk at all of the New York campuses; the most common cause of this type of risk is a severe pipe leak or rupture. The HMAP team recommended ultrasonic testing of older piping along with spot leak detection in some major mechanical areas. For the hospital campus located in the 500-year flood zone, the HMAP team recommended wet-proofing major mechanical areas and isolating these areas with watertight doors and dams. Relocating key utility systems was discussed but ultimately not recommended due to the size and complexity of these major systems.

Fire. Each campus has an approved fire alarm system. The HMAP team recommended adding fire protection systems in key mechanical areas.

Loss of power. To enable facilities to withstand a loss of utility power and provide redundancy to the existing emergency generator distribution systems, the HMAP team recommended the organization provide additional exterior connections to the facilities' emergency electrical systems.

High winds. Unsecured rooftop equipment is a major safety concern during any high wind event. The HMAP team recommended securing all rooftop equipment using wind-bracing designs that exceed the minimum design criteria required by authorities having jurisdiction.

Extreme temperature/HVAC failure. The HMAP team reviewed the organization's chilled water plants to assess their ability to meet operational needs during an extended period of 95-degree temperatures or higher. Their recommendation was to provide additional chilled water capacity and external connections for temporary chillers at all campuses.

Interruption in fuel oil supply. Fuel oil capacities and operational redundancies were evaluated, and provision of a redundant oil tank at the emergency system was recommended. The HMAP team also recommended wet-proofing vital storage areas, inspecting each fuel oil system, and ensuring a continuous supply of fuel is available for

a minimum of 96 hours (similar to NFPA and Joint Commission standards).

Domestic water failure. The majority of domestic water failures are local events; therefore, the campus as a whole may not be at risk. If a major, citywide water failure were to impact the supply to an entire campus, normal operations would not be able to continue.

Estimating Costs and Schedule

The HMAP team provided a sample schedule for implementing hazard mitigation recommendations. Each project was reviewed and assigned to a short-term, mid-term, or long-term implementation schedule; see examples in Table A4-2.

Table A4-2: Sample Mitigation Implementation Schedule

	ID	Description
Short-Term 1–2 Years	1	Provide external connections for a stand-by generator.
	2	Wet-proof incoming electrical service and basement levels to protect from flooding.
	3	Reroute generator exhaust and add fuel oil tank for generator.
	4	Reinforce rooftop equipment to ensure it can withstand hurricane winds/seismic bracing.
	5	Replace roofing as necessary to maintain weather-tight conditions.
Mid-Term 3–5 Years	6	Provide a pre-action sprinkler system in electrical rooms. Provide sprinkler coverage of chiller and boiler rooms. Install foam suppression system.
	7	Install additional fuel oil tanks and related equipment and elevate above the design flood elevation, if applicable.
	8	Provide additional valved and capped domestic/process water for roll-up tanker.
	9	Provide additional valved and capped chilled water outlets for a roll-up chillers.
	10	Provide external connections for a temporary boiler.
	11	Maintain hospital services to inpatient areas. Provide redundant utility power (including emergency power) to maintain hospital services.

Table A4-2: Sample Mitigation Implementation Schedule *(continued)*

	ID	Description
Long-Term 6–8 Years	12	Move electrical equipment out of design flood elevation.
	13	Provide a redundant domestic water loop to serve all buildings.
	14	Provide redundant cooling systems.
	15	Interconnect main fire piping systems within a campus to provide a redundant fire protection water loop to serve all buildings.
	16	Connect medical gas equipment and associated ventilation source to central distribution system.

Appendix 4-2: Case Study—Polar Vortex of 2019

In January 2019, a polar vortex led to an arctic cold outbreak that affected a large part of the Midwestern United States. The severe storm warning issued by the National Weather Service predicted six to 12 inches of snow and windchills of 40˚F to 50˚F below zero. Schools and universities closed, the U.S. Postal Service halted deliveries, and many businesses advised employees to remain home as the region endured record-low temperatures.

Genesis Health System (GHS) in Davenport, Iowa, is accustomed to below-freezing temperatures and the challenges these conditions bring. However, the polar vortex's anticipated duration combined with record-low temperatures presented challenges that exceeded those of typical cold weather events the health system had experienced. In the days prior to the storm, GHS evaluated internal and external operations and formulated an emergency operations plan specific to the event.

Figure A4-2: Genesis Health System, East Campus, Davenport, Iowa

Source: IMEG Corporation, 2019

Prior to the Storm

GHS identified potential cold-weather issues and took action to remedy these concerns in the days before the 2019 polar vortex arrived.

Staffing. GHS worked with facility and maintenance staff to set up a 24/7 rounding schedule of several days duration, and local contractors agreed to provide additional staff resources in the event of an emergency.

Supply chain and inventory. Supply chain and materials management staff evaluated existing inventory and determined which supplies were scheduled for restocking during the storm. Anticipating delivery delays, staff ordered a surplus of critical supplies, such as those needed for medical gas.

Mechanical equipment. An equipment inspection was conducted to ensure the following were operational: air-handling unit (AHU) filters, dampers, actuators, airflow meters, temperature sensors,

Figure A4-3: Genesis Health System's Air-Handling Units

Staff members inspected AHU filters, dampers, heating control valves, and low-limit switches to ensure systems were ready for the arctic storm.

Source: IMEG Corporation, 2019

heating control valves, and low-limit switches. Existing AHU coils were examined to determine the outside air conditions and air volume they could support during extreme cold conditions and to identify any equipment at particular risk because of its location (e.g., near an exterior wall).

Exterior doors. Exterior door and vestibule seals and closures were inspected and improved or repaired, where needed.

Portable heaters. A surplus of portable electric heaters was moved from storage to locations where the greatest need was anticipated (e.g., the loading dock and vestibules).

During the Storm

The following steps were taken during the polar vortex to mitigate the storm's impact on patient care and facility operations.

Snow removal. Snow removal began with the first snowfall and continued regularly to prevent snow buildup and compaction in heavily trafficked areas.

Entry assistance. Staff members were stationed at entrances to assist with patient arrival as the number of patients being dropped off increased.

Security monitoring. Security staff increased monitoring of patient and staff parking lots to assist people who needed help getting to the building or jump-starting vehicles.

Building systems. AHUs and temperatures in critical areas were continuously monitored to enable staff to adjust the system as needed. Thermostats were placed in susceptible areas to track the temperature every hour. Portable heaters provided supplemental heat in loading docks, vestibules, exterior stairwells, and several offices.

Staff rounding. Several staff members were on continuous rounds to inspect entrances and vestibules, loading docks, mechanical rooms, and locations where pipes had frozen in the past.

Conclusion

The polar vortex began on Wednesday, January 29, 2019, and lasted four days. The Midwest region experienced wind gusts of 40 miles per hour, wind chills of negative 50°F, and 48 hours of temperatures below 0°F. Despite these extreme conditions, GHS experienced only minor challenges (e.g., a domestic water pipe in an exterior shaft froze but was quickly addressed by staff and contractors). Early preparation and planning made it possible for GHS to keep their infrastructure running and patients and staff safe during this historic weather event.

Appendix 4-3: Case Study—2003 Southern California Wildfires

In 2003, southern California experienced a combination of severe drought, Santa Ana winds (seasonal southern California winds known for being extremely strong and dry), and low levels of humidity—a trifecta of conditions that led to raging wildfires. From October 21 to November 4, the region was devastated by multiple large fires that burned simultaneously. The Cedar Fire in San Diego County burned at a rate of 3,600 acres per hour, the largest single fire in California's history (in terms of acres burned) at the time of its occurrence. Concurrently, the Paradise Fire rapidly spread just north of the Cedar Fire and the Otay Fire quickly spread to the

Figure A4-4: Cedar Fire Engulfs the Scripps Ranch Residential Community

Cedar Fire aerial - Fire burns towards houses in Scripps Ranch along Pomerado Road in San Diego on Sunday morning, 10/26/2003. Union-Tribune Photo/John Gibbins (John Gibbins U-T)

Source: *San Diego Union Tribune*, https://www.sandiegouniontribune.com/communities/north-county/sd-no-climate-fire-20170519-story.html

south. During the fire event, thousands of smaller fires joined the Cedar, Paradise, and Otay fires, adding to the devastation. Before the fires were extinguished, 24 lives were lost, more than 750,000 acres were burned, and thousands of homes were destroyed. These fires left a lasting mark on San Diego County, including its health care facilities.

San Diego is home to Scripps Health, a health care system with five hospitals and 19 outpatient facilities in southern California. Like other institutions in the region, Scripps routinely considers the threat of wildfires in its hazard vulnerability assessment. Wildfires present specific challenges due to their unpredictable size, location, and wind conditions. For these reasons, many facilities in the Scripps system focused their emergency operation plans for wildfires on defending in place.

Prior to the Wildfires

Scripps Health identified areas of concern and implemented the following actions to prepare for the 2003 wildfires:

Staffing needs. The unpredictability of the wildfires meant that roads were likely be blocked, hindering staff ability to safely gain access to and from sites as fires encroached. Department leaders identified which staff members could remain on-site for the duration and designated space in the facility to accommodate staff members' housing needs.

Supply chain evaluation and inventory stocking. Access to the facilities was expected to be disrupted by the fires. To prepare for disruption in the supply chain, Scripps Health evaluated their existing inventory and planned for additional needed supplies (e.g., portable high efficiency particulate air (HEPA)/carbon filter air scrubbers used to help reduce smoke-related odors). Particular attention was paid to items scheduled for restocking during times of anticipated road closures.

Inspection of air-handling units (AHUs). An inspection was conducted of all AHU filters, dampers, and actuators. Scripps

Health facilities had a mix of AHUs with outside air dampers that could be manipulated by the building automation system (BAS) and AHUs that could not be manipulated by the BAS. The ability to manipulate the dampers as the wildfires neared was needed to reduce the harmful effects of smoke. For those AHUs that could not be manipulated by the BAS, blank off panels were used to allow staff to adjust the airflow manually.

Site inspection. Though the terrain surrounding Scripps Health facilities is evaluated yearly for combustion risks, an additional evaluation was conducted when risks were high.

During the Wildfires

The following actions were taken by Scripps Health during the 2003 southern California wildfires event. These actions could apply to other facilities in the midst of a wildfire event:

Communication with local fire department. Communication with local fire departments was maintained throughout the event. Updates on the fires' severity and anticipated path of travel were essential to making informed operational decisions.

Staff rounding. Monitoring of exterior and interior grounds increased during the wildfire event. Portable HEPA/carbon filter air scrubbers were used in areas where smoke odors were the strongest. For example, in one hospital more than 30 scrubbers throughout the facility were used for this purpose.

After the Wildfires

In the days and weeks after the fires were extinguished, Scripps Health reevaluated their emergency response in preparation for future wildfire threats.

Facility damage. Scripps Health experienced no lasting damage to their facilities or grounds after four days of defending in place. Clinical, operations, and facility staff modified their plans as

conditions and threats changed; these actions helped Scripps Health avoid damage and simplified post-event assessments.

Lessons learned. The following were cited as lessons learned after the event:

- Recognize that wildfires are unpredictable and plans may need to be modified *in situ*. Strong communication between clinical and operations teams is critical.
- Ensure all outside air dampers—whether minimum outside air or economizer dampers—can be manipulated through the BAS. This allows staff to make changes from an operator workstation rather than having to send personnel throughout the building.
- Keep an ample supply of portable HEPA/carbon filter air scrubbers to minimize smoke odor and particulates.

Appendix 7-1: Case Study—Lessons Learned After Hurricane Katrina

After an emergency event takes place, it may be necessary to move residents from their existing residential care setting to an alternate care site while reconstruction or repairs take place in the care facility where they reside. This was the case after Hurricane Katrina when Haven Nursing Center, a 133-bed nursing home in Columbia, Louisiana, welcomed 47 residents from Wynhoven Health Care Center, a 180-bed nursing home in Marrero, Louisiana, after flood waters rose and forced evacuation of Wynhoven.

In an interview with FGI Emergency Conditions residential subcommittee members, KaraLe Causey, COO of Haven Nursing Center, attributed much of Haven's success in taking in the Wynhoven residents to their efforts to maintain the social network of Wynhoven within the Haven Nursing Center environment. Haven had an unused 42-bed wing on its campus and an empty daycare center that could be converted on short notice for the incoming residents. Residents were able to have the same type of room at Haven that they had before they were relocated. If a resident had a private room at Wynhoven, they were given a private room in the converted unit. If they had had a roommate, they continued living with that person. This continuity resulted in very few adverse events associated with relocation of the residents. Forty-seven residents arrived and 47 residents returned to Wynhoven with only three hospitalizations.

Ms. Causey also believes Wynhoven's evacuation plan was vital to a satisfactory outcome. Wynhoven placed ID bracelets on all residents evacuated to Haven Nursing Center. In addition to sending wheelchairs and durable medical equipment for the evacuees, staff from the Wynhoven facility accompanied the residents so they would have familiar caregivers in their new home. Finally, the evacuation plan included a plan for returning to Wynhoven once conditions permitted.

In Columbia, community resources were leveraged to help smooth the way for the evacuees. Cooperation between the community and

Haven Nursing Center allowed the facility to stretch staff hours and boost morale. Volunteers helped with cleaning rooms and moving equipment, and clothes and other necessities were donated for the Wynhoven residents. Accommodations were provided for displaced Wynhoven staff and their families. In networking with other providers, Haven Nursing Center was able to gain access to a wealth of resources and talents they did not have in their existing organization.

The experience they had housing residents from Wynhoven after Hurricane Katrina has helped Haven Nursing Center be more flexible and better prepared for future emergency conditions. Ms. Causey attributed Haven's early response to the COVID-19 pandemic, assembling appropriate stakeholders and quickly implementing an action plan, to the planning involved in hosting evacuated residents and the lessons learned from that effort.

Appendix 7-2: Case Study—Manitoba's Personal Care Homes

The government of Manitoba, Canada, handled the issue of visitors for residents during the COVID-19 pandemic in a way that provides good lessons for other residential care providers. Their approach for personal care homes (PCHs)—the province's equivalent to nursing homes—explored both dedicated internal and external solutions. The province issued a request for proposals to solicit ideas from vendors of infection prevention supplies, manufacturers of temporary shelters, and off-site fabrication experts and partnered with architects and engineers to initiate a think tank to explore the art of the possible. Proposed solutions were then evaluated for their potential to provide a visitation solution at each of the 129 PCH locations throughout the province. A key consideration was the ability to manage the materials supply chain to avoid competition among the facilities for source materials. Internal retrofit solutions were preferred in urban settings where land was less available, but in rural locations with more property temporary external visitation portable-on-demand (POD) structures were favored.

To support safe visitation, each visitation room solution (internal or external) was required to meet the following objectives:

- There shall be no cross-circulation between visitors and residents, and visitors must enter the space either directly from the exterior or immediately from an entry vestibule.
- Where visitors enter the space directly from the outside, they shall do so by passing through a vestibule first to protect the room from the harsh exterior elements.
- The layout of each space shall be designed to accommodate three visitors and one resident and allow a physical distance of 1.8 meters (6 feet) to be maintained between individuals at all times during a visit.
- Mechanical systems for the visitation space shall be isolated from the remainder of the building and conform to very specific performance objectives.

The intention of the visitation room is to create a safe space for family visitation, but the room is not intended to meet the same performance criteria as an acute care airborne infection isolation room. Care and attention should be given to ensure the space can maintain a small negative pressure, but it does not require an anteroom. It is understood the room pressure will be disrupted momentarily when individuals enter and exit the space. Typically, Manitoba PCHs are to maintain a minimal ventilation design of 4 air changes per hour (ACH).[4] However, for effective air disinfection, ventilation rates of 6 to 12 ACH have been required in the PCH visitation rooms. As well, additional systems were considered to enhance air disinfection. Portable air cleaners were considered initially but eliminated because their specified clean air delivery rates were generally too low to provide adequate protection. Induct UVGI was considered but excluded due to conflicting research indicating these systems may require increased exposure times for the bio-laden air, requiring extended-length duct runs that made the solution impractical for the visitation rooms.

The airborne risk from COVID-19 had not been definitively established when the Manitoba effort was first underway. However, evidence suggested that an airborne component of transmission was likely based on what was known about other respiratory viruses, such as severe acute respiratory syndrome (SARS), Middle East respiratory syndrome (MERS), and influenza.[5] Therefore, Manitoba chose to require the design of each visitation space to include a laminar airflow with a specific air pattern from a clean (susceptible) zone through a dirty (infector) zone to facilitate scrubbing the room.

To keep creation of the visitation spaces affordable, the requirement for pressurization room monitoring remained optional. However,

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4 Canadian Standards Association, CSA.317.21 in CSA Standard Z8000-11: *Canadian Healthcare Facilities* (Mississauga, Ontario: CSA Group, 2011).

5 Na Zhu et al., "A Novel Coronavirus from Patients with Pneumonia in China, 2019," *New England Journal of Medicine* 382, no. 8 (February 2020): 727–33, https://doi.org/10.1056/NEJMoa2001017; and Michael A. Kohanski, L. James Lo, and Michael S. Waring, "Review of Indoor Aerosol Generation, Transport and Control in the Context of COVID-19," *International Forum of Allergy & Rhinology* 10, no. 10 (October 2020): 1173-79, https://doi.org/10.1002/alr.22661.

each room was required to include a carbon dioxide (CO_2) monitoring system that was easy to read and visible to visitors. Carbon dioxide monitors are relatively inexpensive and can provide an indication of successful ventilation operations. Exhaled air is the vehicle for infectious particles and contains almost 40,000 parts per million (ppm) of CO_2 compared with approximately 350 ppm in outdoor air.[6] Carbon dioxide may be considered a surrogate for exhaled breath. Thus, the portion of inhaled air that has been previously exhaled by a person can be easily determined. Visitation should not be continued if CO_2 levels in the POD exceed 700 ppm.

Ventilation rates alone are not sufficient to achieve effective and safe distribution of air patterns within a POD. Therefore, consideration was also given to locating air supply inlets and exhaust outlets to achieve a mix rate and flow that could maintain distribution patterns and minimize the likelihood of airborne cross-infection. Research indicates the most effective design for ventilation systems in hospital isolation rooms is to supply clean air high above the patient zone (clean zone) and then exhaust air low at the perimeter of the room (infectious zone).[7] The same design methods were adopted for the PCH PODs, where the supply air entered directly above the resident and was exhausted at the low bench level in the visitor's zone. Ceilings should be monolithic to maintain better performance of pressure differential. Research indicates that solid ceilings are twice as effective as lay-in ceilings for this purpose.[8]

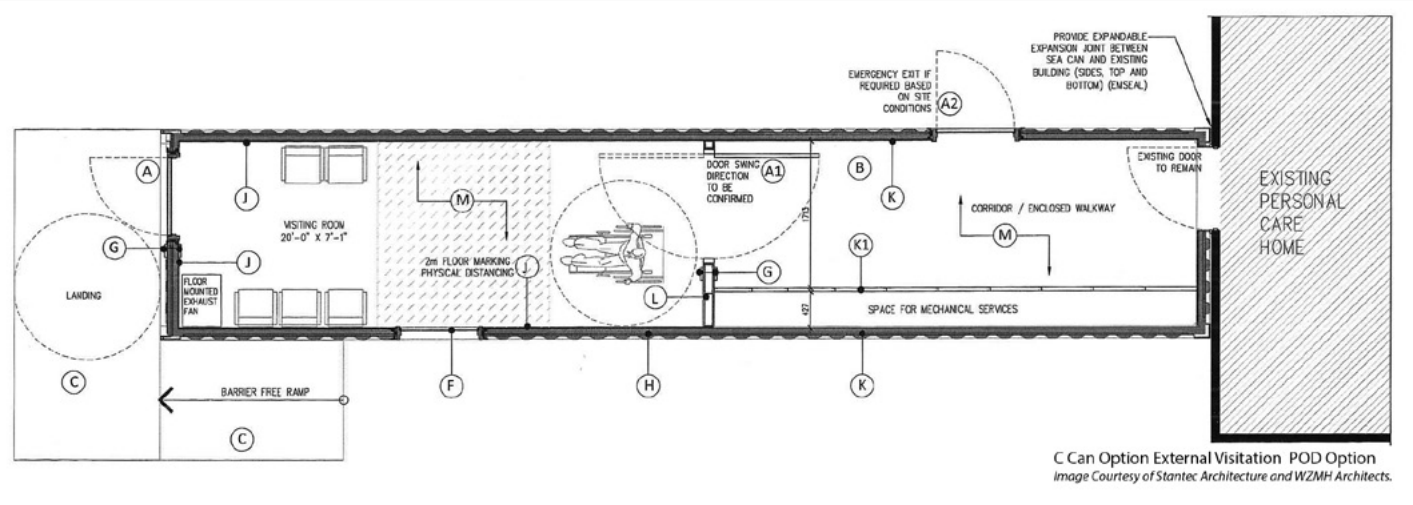
It was important that the solution developed by the province reflect the economics of the situation given the reality of the capital cost challenges facing individual care providers. The advantage of the

6 S.N. Rudnick and D. K. Milton, ""Risk of Indoor Airborne Infection Transmission Estimated from Carbon Dioxide Concentration," *Indoor Air* 13, no. 3 (September 2003): 237–45, https://doi.org/10.1034/j.1600-0668.2003.00189.x.

7 K. W. D. Cheong et al., "Assessment of Thermal Environment Using a Thermal Manikin in a Field Environment Chamber Served by Displacement Ventilation System," *Building and Environment* 41, no. 12. (December 2006): 1661-70, https://doi.org/10.1016/j.buildenv.2005.06.018.

8 Marko Hyttinen et al. "Airborne Infection Isolation Rooms—A Review of Experimental Studies." *Indoor and Built Environment* 20, no. 6 (July 18, 2011): 584-94. https://doi.org/10.1177/1420326X11409452.

Figure A7-1: Portable On-Demand Outdoor Shelter



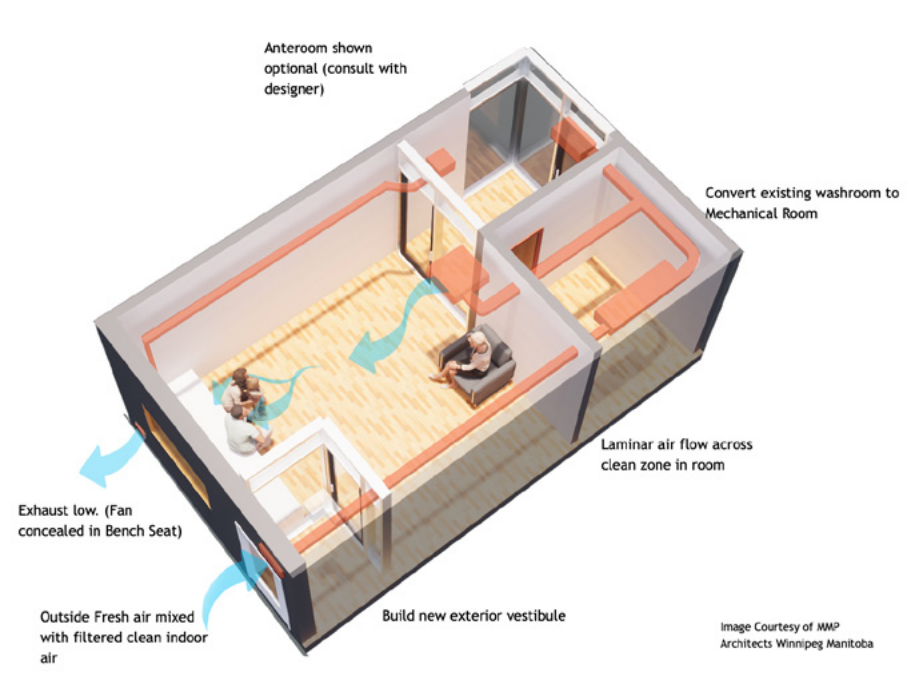
Source: Stantec Architecture and WZMH Architects

external visitation PODs was the ease and speed of erecting a shelter on each site. These PODs can be premanufactured off-site and simply placed in a location that offers suitable access to the facility.

Unless an external visitation POD can be repurposed, however, disadvantages of this solution are potential challenges associated with zoning bylaws for each location and lost value once the temporary POD is removed. In contrast, internal visitation solutions will retain their value long after the pandemic as these rooms can continue to be used as safer visitation areas during influenza outbreaks. In addition, the internal solution was about 30 percent less expensive than the introduction of an external POD shelter.

Early internal retrofit solutions looked at using all or a portion of an existing room adjacent to the building entry vestibule. It was thought this was ideal because no new openings would need to be made in the exterior of the building and visitors would be able to access the space directly at the building entry. But after some consideration of the entry and lobby spaces at existing PCHs, it was determined the conversion of a resident room or similar space, despite the need for a new opening in the building, made for an easier and less expensive conversion because of its smaller scale and physical characteristics.

Figure A7-2: Indoor Shelter for Visitation



Source: MMP Architects Inc.

Draft *Guidelines for Emergency Conditions in Health and Residential Care Facilities*

The recommended guidelines presented here have been consolidated from the independently developed recommendations at the end of the chapters in this white paper. Because experience from the field is critical to developing requirements and recommendations that are neither too restrictive nor too permissive, users of the *Guidelines* are encouraged to comment on the proposed changes using FGI's online comment platform. For more about the draft FGI Emergency Conditions *Guidelines* and the comment period, please read the preface at the beginning of this white paper.

The proposed new language shows changes to the 2018 FGI *Guidelines* recommended by the Emergency Conditions Committee. Additions are underlined, and deletions indicated with a ~~strikethrough~~. Where an appendix item (i.e., a non-enforceable recommendation or guidance on applying a requirement) has been provided, an asterisk (*) precedes the section number (e.g., *1.2-4 Safety Risk Assessment). Appendix items can be identified by the letter "A" that precedes the correlating section number (e.g., A1.2-4 SRA). The text shown has been excerpted from the 2018 *Guidelines* and is not comprehensive.

Proposed Language Based on the 2018 Hospital *Guidelines*

Chapter 1.1 Introduction

***1.1-2 New Construction**

Projects with any of the following scopes of work shall be considered new construction and shall comply with the requirements in the *Guidelines for Design and Construction of Hospitals*:

> **A1.1-2 Resiliency in new construction.** Incorporation of design elements for resiliency should be considered for new construction projects where continuity of patient care services is required in the event of an emergency. Refer to Section 1.2-4.9 (Disaster, Emergency, and Vulnerability Assessment) for applicability.

1.1-3 Renovation

1.1-3.1 General

1.1-3.1.1 Compliance Requirements

***1.1-3.1.1.1** Where renovation or replacement work is done in an existing facility, all new work or additions or both shall comply with applicable sections of the *Guidelines* and local, state, and federal codes.

> **A1.1-3.1.1.1 Resiliency in renovation projects.** Incorporation of design elements for resiliency should be considered when renovating an existing facility where continuity of patient care services is required in the event of an emergency. Refer to Section 1.2-4.9 (Disaster, Emergency, and Vulnerability Assessment) for applicability.

Chapter 1.2 Planning, Design, Construction, and Commissioning

1.2-2 Functional Program

...

1.2-2.2 Functional Program Content

The functional program for a project shall include the following:

...

1.2-2.2.7 Operational Requirements

The operational requirements, which include but are not limited to the following, shall be described:

1.2-2.2.7.1 Projected operational use for project components

1.2-2.2.7.2 Relevant operational circulation patterns, including movement of staff, patients and their companions, members of the public, and materials and equipment

1.2-2.2.7.3 Departmental operational relationships and required adjacencies

1.2-2.2.7.4 Projected operational use and surge capacity of project components during emergency conditions

> **A1.2-2.2.7.4** Projections for operational use and surge capacity during emergency conditions are identified in these facility-specific assessments: safety risk assessment (infection control risk assessment and disaster, emergency, and vulnerability assessment portions) and hazard vulnerability assessment.

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*1.2-4 Safety Risk Assessment (SRA)

A1.2-4 SRA. The safety risk assessment is an interdisciplinary, documented assessment process used to proactively identify hazards and risks and mitigate underlying conditions of the built environment that may contribute to adverse safety events. These adverse events include infections, falls, medication errors, immobility-related outcomes, security breaches, and musculoskeletal or other injuries. The SRA also includes assessment of the hazards and risks from natural and man-made emergency conditions.

The SRA process includes evaluation of the population at risk and the nature and scope of the project; it also takes into account the models of care, operational plans, sustainable design elements, and performance improvement initiatives of the health care organization. The SRA proposes built environment solutions to mitigate identified risks and hazards.

*1.2-4.1 General

A1.2-4.1 More information and online tools to assist in the development of an SRA can be found on the websites of the Facility Guidelines Institute and the Center for Health Design. As well, information about the SRA and the disaster, emergency, and vulnerability assessment can be found in the FGI white paper *Guidance for Designing Health and Residential Care Facilities that Respond and Adapt to Emergency Conditions.*

1.2-4.1.1 SRA Requirement

1.2-4.1.1.1 All hospital projects shall be designed and constructed to facilitate the safe delivery of care.

1.2-4.1.1.2 To support this goal, a multidisciplinary team shall develop a safety risk assessment.

1.2-4.1.2 SRA Components

See Table 1.2-1 (Safety Risk Assessment Components) to determine if the following SRA components are required for a project:

1.2-4.1.2.1 Infection control risk assessment (ICRA)

1.2-4.1.2.2 Patient handling and movement assessment (PHAMA)

1.2-4.1.2.3 Fall prevention assessment

1.2-4.1.2.4 Medication safety assessment

1.2-4.1.2.5 Behavioral and mental health risk assessment

1.2-4.1.2.6 Patient immobility assessment

1.2-4.1.2.7 Security risk assessment

1.2-4.1.2.8 Disaster, emergency, and vulnerability assessment (DEVA)

1.2-4.1.3 SRA Responsibility and Scope

1.2-4.1.3.1 The safety risk assessment shall be initiated and managed by the governing body during the planning phase of the project. ~~and~~

1.2-4.1.3.2 The safety risk assessment shall evolve with additional levels of detail as needed to support the creation of a safe environment throughout the design, construction, and commissioning phases of a project.

***1.2-4.1.5 SRA Process**

A1.2-4.1.5 SRA tools and methods. A range of high-priority activities to improve patient and caregiver safety

outcomes should be considered during the predesign, design, and construction phases of a project.

***1.2-4.1.5.1 Identify hazards ~~and potential risks~~.** The governing body shall provide an assessment of the potential ~~harm to~~ hazards for patients, caregivers, and other users for the ~~risks~~ components listed in Table 1.2-1 (Safety Risk Assessment Components), identifying ~~the following: *(1) H~~ hazards specific to the project.

A1.2-4.1.5.1 ~~(1)~~ Hazards

a. Hazards include circumstances, processes, human activities, physical obstacles, and underlying conditions that may directly or indirectly contribute to harm to patients, staff, or other users or contribute to damage or loss. See appendix section A1.2-4.1.5.2 (Evaluation of underlying conditions that can cause adverse safety events) for more information.

b. Some hazards may be more anticipated than others (e.g., regionally associated weather events). Anticipated hazards may come with some level of advance notice (e.g., minutes or hours for a tornado watch/warning or days for a potential hurricane landfall). Other hazards may be unanticipated (e.g., an explosion of stored chemicals, a terrorist attack). Some hazards may start as unanticipated and evolve into an anticipated event (e.g., a global pandemic).

~~(2) Historical data and/or national patient and caregiver safety trends relevant to the identified hazards~~

~~(3) Prioritization of the degree of potential harm to patients and/or caregivers from the identified hazards~~

***1.2-4.1.5.2 Evaluate ~~hazards and~~ risks from identified hazards.** The SRA team shall evaluate underlying conditions that contribute to an unsafe environment for the components listed in Table 1.2-1

(Safety Risk Assessment Components) and estimate associated risk considering both of the following: :

(1) Likelihood (vulnerability), using historical data and/or national patient and caregiver safety trends relevant to the identified hazards

(2) Consequence (estimated degree of potential harm to patients and/or caregivers from identified hazards)

A1.2-4.1.5.2 Evaluation of underlying conditions that can cause adverse safety events

a. Underlying conditions include the physical environment, organizational and social factors, and task characteristics that can be affected by the design of a space, including the following:

—Noise

—Vibration

—Visual distraction and disorganization of space

—Light type, quality, and quantity for each location

—Surface characteristics for different spaces

—Indoor air characteristics for different spaces

—Sources of infection

—Ergonomics

—Staff fatigue

—Space required to accommodate functions

—Standardized locations for equipment (e.g., medical gas outlets on patient room headwalls, emergency call buttons)

—Opportunities for, and barriers or disincentives to, mobilization of patients

—Impediments to movement, maneuvering, and flow

—Communication systems

—Visibility of patients

—Automation (where possible)

—Support for family involvement in patient care

~~b.~~ For additional information, see the Center for Health Design report "Designing for Patient Safety: Developing Methods to Integrate Patient Safety Concerns in the Design Process," which identifies 10 environmental factors as "latent conditions that can be designed to help eliminate harm." Such "built environment latent conditions [holes and weaknesses] that adversely impact patient safety" should be identified and eliminated during the planning, design, and construction of outpatient facilities. The report can be found on the Center for Health Design website.

b. In the category of emergency preparedness, a hazard can include earthquakes, hurricanes, tornadoes, and other "natural" events. Hazards can also include terrorism, chemical spills, explosions, or other "man-made" events.

***1.2-4.1.5.3 Generate solutions.** The SRA team shall document proposed solutions that mitigate risks from the identified hazards.

A1.2-4.1.5.3 In the context of disaster and emergency preparedness, the solutions should be integrated into the organization's hazard vulnerability assessment.

***1.2-4.1.6 SRA Report**

After completing the SRA process, the governing body shall provide the following information and recommendations, which shall be incorporated into the planning and design documentation:

A1.2-4.1.6 SRA report~~.~~

a. Time and effort should be dedicated to patient and caregiver safety issues during the predesign phase (e.g., strategic planning, master planning, operational planning, and programming) of a hospital design project. The decisions made during predesign significantly affect the design parameters going forward and the safety outcomes of the project following occupancy. The safety risk assessment should be an important part of the continuous safety improvement program in any health care organization.

b. Requirements for submission may vary by AHJ and the SRA may not be required until permitting, but this does not preclude the benefit of early planning and documentation to ensure inclusion of integrated solutions that mitigate risk in the built environment.

c. Health care organizations are required by CMS and others to conduct hazard vulnerability assessments (HVAs). Design solutions that support the safe delivery of care during disasters and emergencies should be coordinated with and supplement existing mandated HVAs. The intent of the disaster, emergency, and vulnerability assessment (DEVA) portion of the SRA report is to proactively identify built environment solutions (beyond critical infrastructure) that mitigate risk from potential hazards.

1.2-4.1.6.1 Patient and caregiver safety hazards and risks identified by the safety risk assessment. See Section 1.2-4.1.5.1 (Identify hazards and potential risks).

1.2-4.1.6.2 Design features that contribute to the identified hazards and risks

1.2-4.1.6.3 Design strategies to reduce, mitigate, or eliminate identified hazards and risks

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***1.2-4.2 Infection Control Risk Assessment (ICRA)**...

***1.2-4.3 Patient Handling and Movement Assessment (PHAMA)**...

***1.2-4.4 Fall Prevention Assessment**...

***1.2-4.5 Medication Safety Assessment...**

***1.2-4.6 Behavioral and Mental Health Risk (Psychiatric Patient Injury and Suicide Prevention) Assessment**...

***1.2-4.7 Patient Immobility Assessment**...

***1.2-4.8 Security Risk Assessment...**

A1.2-4.8.2.1 Security elements of the safety risk assessment

a. *Security considerations for project design*....

b. *Security for emergency management.* Hospitals frequently provide both scheduled and emergency services, serve as part of local emergency response networks, and are expected to be functional, safe, and secure for patients, visitors, and staff while remaining prepared for natural and man-made emergencies 24 hours a day.

—The design of the facility should address the facility's role in responding to internal and external emergencies on its own or in coordination with local emergency

response or public health authorities based on assessed risks. All other regulations for emergency operations should be considered when developing the design.

~~An all-hazards approach to design should be applied to help the facility prepare for, respond to, and recover from man-made events and natural disasters.~~

***1.2-4.9 Disaster, Emergency, and Vulnerability Assessment (DEVA)**

A1.2-4.9 Disaster, emergency, and vulnerability assessment

a. The DEVA should include information developed as part of any facility-based hazard vulnerability assessment, but it should more specifically address the emergency preparedness program as it pertains to proactive design or renovation of the facility.

b. An all-hazards approach to design should be applied to help the ~~facility~~ health care organization prepare for, respond to, and recover from man-made events and natural disasters. [Moved from A1.2-4.8.2.1 in the security risk section (see above).]

***1.2-4.9.1 Disaster, Emergency, and Vulnerability Elements of the Safety Risk Assessment**

A1.2-4.9.1 A range of hazards and vulnerabilities should be considered in performing a facility-based disaster, emergency, and vulnerability assessment. The DEVA should include, but is not limited to, identification and review of the following:

a. Anticipated hazards (e.g., earthquake, hurricane)

b. Unanticipated hazards (e.g., explosion, infectious disease, hazardous material)

c. Patient population (e.g., acuity, functional needs)

d. Facility type

e. Potential surrounding community assets (assets in a rural area will differ from those in a large metropolitan area)

1.2-4.9.1.1 Anticipated hazards

*(1) The multidisciplinary team shall review the organization's hazard vulnerability assessment (HVA) in conjunction with the development of the DEVA.

A1.2-4.9.1.1 (1) The hazard vulnerability assessment should be shared with the design team at the earliest stages of planning to confirm what has been established and which decisions should be reviewed with the design team.

(2) The DEVA shall identify anticipated hazards specific to a facility based on its geographic location.

1.2-4.9.1.2 Design features. Design features that provide resilience, hardening, flexibility, and adaptability during a disaster or emergency event shall be identified.

***1.2-4.9.2 Disaster, Emergency, and Vulnerability Response**

The design team shall incorporate identified disaster and emergency-related design features in the project design documents.

A1.2-4.9.2 Health care organizations should consider which areas of the hospital are likely to be converted to patient care in the event of a disaster. These spaces are not intended for provision of routine patient care, resolution of capacity issues that result from poor planning, or anticipated surge events (e.g., seasonal flu).

***1.2-5.4.3 Wayfinding**

How clarity of access will be provided for the entire campus or facility using a wayfinding system. See Section 1.2-6.3 (Wayfinding) for more information.

A1.2-5.4.3 Wayfinding

a. Hospital entry points should be clearly identified from all major exterior circulation modes (e.g., roadways, bus stops, vehicular parking).

b. Clearly visible and understandable signage, icons, universal symbols, visual landmarks (including views to the outside), and/or cues for orientation (including views to the outside) should be provided.

c. Boundaries between public and private areas should be well marked or implied and clearly distinguished.

d. A system of interior "landmarks" should be developed to aid occupants in cognitive understanding of destinations. To be effective, landmarks should be unique and used only at decision points. Landmarks may include sealed water features, major art, distinctive color, or decorative treatments. These features should attempt to involve tactile, auditory, and language cues as well as visual recognition. When color is used as a wayfinding device, it should support the primary wayfinding system elements and be clearly distinguished from color palette decisions unrelated to wayfinding.

e. Signage systems should be flexible, expandable, adaptable, and easy to maintain. Signage should be consistent with other patient communications and supporting print, Web, and electronic media.

f. Health care organizations should consider how signage and wayfinding can be adapted during a disaster to provide meaningful real-time information for patients and staff. Consider a temporary signage plan that identifies the following:

—New uses and functions

—Zones of use, including but not limited to:

- Staff zones
- Public zones
- "Clean" vs. "contaminated" zones

1.2-6.5 Emergency Preparedness and Management

1.2-6.5.1 Planning and Design Considerations

During project planning and design, the following shall be considered:

***1.2-6.5.1.1** The likelihood that a facility will experience events that go beyond a facility's normal operations

A1.2-6.5.1.1 Emergency preparedness assessments

The likelihood that a facility will experience events that go beyond normal operations should be assessed and detailed in an annual hazard vulnerability assessment (HVA) ~~emergency preparedness assessment~~. These events could include natural disasters; utility failures; acts or threats of human violence; biological, nuclear or chemical exposures; surge capacity; evacuation; and mass casualties.

a. *Infrastructure assessment.* The ~~assessment~~ HVA should consider performance of structural and critical

nonstructural building systems during an adverse event and the likelihood of loss of externally supplied power, gas, water, and communications from such a disaster.

b. *Hospital facility planning.* Ideally, the ~~emergency preparedness assessment~~ HVA results will be used to ~~implement practices and plans~~ develop or revise an emergency operations plan (EOP) that will help the health care organization prevent, mitigate, and expediently recover from an event. Hospital facility master planning should consider mitigation measures required to address conditions that may be hazardous to patients and conditions that may compromise the ability of the hospital to fulfill its planned post-emergency medical response.

Resiliency requires a plan to absorb and recover from adverse events by preparing, preventing, protecting, mitigating, and responding. The EOP ~~plan~~ should outline a hospital's ability through mitigation and planning to:

—Handle patient influx due to a public health emergency or mass casualty event.

—Coordinate and communicate effectively with community partners.

—Adapt to changing conditions.

—Recover from disruptions.

—Resist probable deliberate attacks.

—Improve technical and organizational capabilities.

—Focus on reducing damage and disruptions to public health and safety.

c. *Wind- and earthquake-resistant design for new buildings...*

d. *Flood protection...*

*1.2-6.5.1.2 Space needs in the event of an emergency for operations to:

A1.2-6.5.1.2 Space needs in an emergency. The location of the facility and the type of event in the community may require a hospital to act as a shelter or support other health care system needs. If so, the following should be considered during planning:

a. Space where patients, staff, and visitors can be safe

b. Provision of ~~space~~ storage for resources needed to respond in an emergency, such as medical supplies, materials, personal protective equipment, pharmaceuticals, communications equipment, transportation, food, water, utilities, and waste storage. Some of these resources could be accommodated through mutual aid agreements between the health care organization and other local providers or vendors. Such storage capacity or plans should be sufficient for at least four continuous days of operation or longer if indicated by the facility's disaster, emergency, and vulnerability assessment (DEVA).

(1) ~~1.2-6.5.2.1~~ Protect facility occupants during the event

*(2) ~~1.2-6.5.2.2~~ Continue providing services as outlined in the health care organization's emergency operations plan (EOP).

A1.2-6.5.1.2 (2) ~~A1.2-6.5.2.2~~ Design for continued building system operation. For those facilities that must remain operational, special design is required to protect systems and essential building services such as power, water, medical gas systems, and, in certain areas, air conditioning. In addition, special consideration must be given to the likelihood of temporary loss of externally supplied power, gas, water, and communications.

***1.2-6.5.1.3** Infrastructure needed to convert a non-clinical space for use as a patient care area, including:

> **A1.2-6.5.1.3** The building system infrastructure needed to increase capacity for areas of the hospital likely to be converted to patient care in the event of a disaster should meet the requirements in Section 2.1-8.1.2 (Building Systems—Surge Capacity Locations).

(1) Essential electrical system power

(2) Access to medical gases

(3) Ventilation

(4) Environmental controls

***1.2-6.5.2 Hospital Incident Command System (HICS)**

> **A1.2-6.5.2 Hospital incident command system (HICS).** The health care organization should assemble a multidisciplinary management team to develop a hospital incident command system in preparation for surge events with a large influx of patients as a result of natural and man-made disasters and emergencies. The HICS management team would be responsible for planning for an organization's emergency response, including development of an emergency operations plan (EOP). Consideration of the following elements is recommended:
>
> a. Site preparation for surge capacity
>
> —Identify locations for temporary structures (including access to the site and staging areas).
>
> —Evaluate the need for additional utility services to accommodate temporary or transportable structures,

mass casualty equipment, and/or expansion to designated areas outside the building.

—Consider parking overflow locations to handle increases in staff, patients, vendors, and visitors during an event.

—Determine the need for event-specific storage for emergency equipment, medical supplies and equipment, portable trailers or mobile units, portable mechanical units (for temporary increase in positive and negative pressure rooms), and temporary partitions to accommodate altered patient flow.

b. Transportation accommodations

—Plan site accessibility to accommodate the increased number of delivery vehicles during a surge event.

—Identify docking and parking needs for daily and temporary supply vehicles.

—Identify ambulance and emergency vehicle docking, parking, and housing needs (including helicopter and plane access).

c. Enhanced communications

—Consider provision of enhanced communications systems to facilitate communication among the incident command center, health care facility staff, and state and local emergency management agencies.

—Identify a location for the incident command center and determine if this location should be permanent or ad hoc. Plan for adequate utility support services and safe storage of communications equipment when not in use. Consider proximity to toilet facilities, nourishment areas, and private offices and meeting rooms.

—Provide telemedicine spaces, equipment, and staff training to accommodate virtual visits and reduce the number of patients and staff on-site during crisis events. Ensure the telemedicine system has the ability to operate uninterrupted in emergency mode.

—Make provisions for a reliable, safe, and secure telecommunications support system with the ability to operate uninterrupted in emergency mode should the need arise.

—Ensure communications systems are able to handle additional needs during an emergency, including telemedicine and work-at-home support systems for non-frontline staff.

d. Access points control and security

—Develop a facility safety and security strategy to control unrestricted access and protect and preserve assets during a crisis.

—Identify access points in the facility for potentially infectious patients (e.g., emergency department and ambulance entrances) and for non-infectious patients (e.g., main entrance and selected entrances for specialty services).

—Identify potential locations of security stations for personnel to monitor and allow access into the facility. Provide a secure location with adequate communication resources to initiate alarms.

—Develop emergency wayfinding plans. Successful wayfinding planning will address alternate use of spaces and campus facilities necessitated by an emergency condition. Signage and electronic wayfinding methodologies should be simple, easy to understand, and capable of adapting to changes in function.

e. Staff services

—Consider the impacts of expanded staff services during a crisis. Plan to accommodate staff needs during prolonged shifts of 12 hours or more.

—Provide accessible locker rooms for staff to secure their belongings and change attire. Ensure availability of such lockers for all essential personnel, including doctors, nurses, maintenance staff, environmental services staff, pharmacists, laboratorians, technicians, etc.

—Evaluate areas in the facility and/or nearby lodging to accommodate overnight stays for staff and their families.

***1.2-6.5.2.1 Incident command center.** At least one room that can be used as an incident command center shall be provided in the hospital.

A1.2-6.5.2.1 Incident command center. Widespread adoption of the hospital incident command system (HICS) into health care emergency operations plans necessitates allocating sufficient space to house the HICS management team during an emergency. Commonly, the space used for an incident command center is a conference room located in a securable staff area that can be repurposed as needed. The room should be sized based on maximum space needed and provide lighting and connection to the essential electrical system and the facility's IT infrastructure.

(1) General. This room shall be permitted to serve other functions (e.g., a conference or training room) during normal conditions.

(2) Space requirements. This room shall meet one of the following requirements:

(a) The room shall have a minimum clear floor area of 200 square feet.

(b) The room shall be sized to provide the number of seats necessary for all critical positions stipulated in the hospital incident command system (HICS) structure.

(3) Building systems

(a) HVAC system

(i) Provisions shall be made to ensure a controlled environment in the incident command center for occupant comfort.

(ii) The ventilation system for the room shall be on the equipment branch of the essential electrical system.

(b) Electrical system

(i) Provisions shall be made for emergency power capabilities in the room as required in Article 708 (Critical Operations Power Systems) in NFPA 70: *National Electrical Code*.

(ii) All systems required for continuous emergency communications and to maintain continuity of service shall be on the essential electrical system.

(c) Communications systems. Provisions shall be made to support cell phone and first responder radio transmission communications.

1.2-6.5.2.2 Storage for the incident command center

(1) Storage for emergency supplies shall be provided immediately adjacent to the incident command center.

(2) The amount of storage shall be determined by the disaster, emergency, and vulnerability assessment.

1.2-6.5.3 Critical Function Areas and Equipment

1.2-6.5.3.1 New construction

(1) Function areas. The following critical function areas shall be located at an elevation above the 100-year floodplain and storm surge level:

(a) Pharmacy

(b) Laboratory

(c) Blood bank/storage

(d) Sterile processing facilities

(e) Elevator equipment rooms

(2) Equipment. The following building service equipment shall be located at an elevation above the 100-year floodplain and storm surge level:

(a) Essential electrical system generators, transfer switches, and main distribution switchgear

(b) Telecommunications and information systems incoming service and distribution equipment rooms

(c) Vacuum pumps and medical air compressors

1.2-6.5.3.2 Renovations. In renovations of existing facilities, critical function areas shall be relocated above the floodplain or storm surge

elevation except where infeasible or space does not permit. In this situation, the health care organization shall create a mitigation plan to ensure continuity of service.

Chapter 1.3 Site

1.3-3.1 Signage

Site signage shall be provided to direct people unfamiliar with the facility to parking areas and entrances.

A1.3-3.1 Temporary signage for emergency conditions. Plans should be considered for temporary signage (including digital) to be installed during emergency conditions to facilitate new circulation and alternate arrival or pickup locations for vehicles and pedestrians.

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*1.3-3.2 Lighting

Site lighting shall be provided for the patient path of travel.

A1.3-3.2 Site lighting.

a. *Lighting controls.* Lighting controls should permit zoned operation, allowing facilities to provide multiple lighting levels or to designate night parking nearer the building. Lighting design for the site, roadway, and parking lots should control glare and minimize light pollution of the night sky or surrounding properties.

b. *Lighting for emergency conditions.* Mobile lighting solutions that can be deployed quickly should be planned for implementation during emergency conditions.

1.3-3.3.2 Pedestrian Walkways

Paved walkways shall be provided for pedestrian traffic.

A1.3-3.3.2 Pedestrian access during emergency conditions. Consideration should be given to how pedestrian access will be handled during a disaster/pandemic scenario. Supplementary pedestrian access routes may be activated or pedestrian access may be more limited. A second public entrance may be opened. Site design should be able to accommodate these possible changes.

1.3-3.4 Parking

*1.3-3.4.1 General

A1.3-3.4.1 Parking

a. *Dedicated parking areas.* Dedicated patient and staff parking should be provided where possible. Additional parking considerations should be provided for emergency services patients.

b. *Alternate use of parking areas during emergency conditions.* During an emergency, parking areas may be used for alternate purposes, such as drive-through testing or a decontamination station. Parking areas should be designed to facilitate planned alternate uses.

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*1.3-3.8 Exterior Surge Capacity Locations

A1.3-3.8 Exterior surge capacity locations. Health care organizations should plan for adaptation of site features

during an emergency event. This includes spaces for mobile or modular units and for temporary structures like tents or vehicles.

Typically, infrastructure-intensive, overnight care is provided within the existing walls of a hospital during a surge event. Transitory, outpatient care may be housed in temporary structures with little infrastructure and limited environmental controls. Other functions that may be augmented by use of temporary mobile units include support spaces for services such as laundry. cleaning, soiled materials decontamination, morgue, and food preparation. Storage and other less critical functions can also be relocated from the hospital to make it possible for patient care to remain in the hospital during an event. Staff staging can also be accommodated outside the hospital.

Health care organizations should be thoughtful about how temporary external assets are arranged so proximity to utility and infrastructure hookups can be provided. Careful attention should be paid to security, crowd control, and access, including visual observation of sensitive functions (e.g., morgue and body transport, access to hospital leadership).

1.3-3.8.1 Health care organizations shall identify in the emergency operations plan (EOP) locations that can be used for temporary or mobile structures during an emergency condition.

1.3-3.8.2 The EOP shall include the following:

1.3-3.8.2.1 Identified locations and planned uses for temporary surge structures

1.3-3.8.2.2 Provisions for utility connections

1.3-3.8.2.3 Potential traffic disruptions and crowd control concerns

Chapter 1.4 Equipment

1.4-1.2 Equipment List

An equipment list shall be developed and maintained throughout the design development process and included in the contract documents to assist in overall coordination of the acquisition, installation, and relocation of equipment.

*__1.4-1.2.1__ The equipment list shall include all items of equipment necessary to operate the facility during normal operations and during emergency conditions.

> **A1.4-1.2.1** When determining equipment needed for operations during emergency conditions, consider additional equipment procurement, storage, and deployment needs.

Chapter 2.1 Common Elements for Hospitals

2.1-2 Patient Care Units and Other Patient Care Areas...

***2.1-2.2 Patient Room**

...

2.1-2.2.9 Building System Components

2.1-2.2.9.1 Patient room requirements

(1) Electrical receptacles. See Table 2.1-1 (Electrical Receptacles for Patient Care Areas in Hospitals).

(2) Call systems. See Table 2.1-2 (Locations for Nurse Call Devices in Hospitals).

(3) Medical gas systems. See Table 2.1-3 (Station Outlets for Oxygen, Vacuum, Medical Air, and Instrument Air Systems in Hospitals).

2.1-2.2.9.2 Surge requirements. Patient rooms intended to accommodate double occupancy during a surge event shall meet the requirements for critical care patient rooms in the tables listed in Section 2.1-2.2.9.1 (Building System Components: Patient room requirements).

***2.1-2.4.2 Airborne Infection Isolation (AII) Room**

...

2.1-2.4.2.1 General

...

(3) Location.

*(a) AII rooms shall be permitted to be located in individual patient care units or grouped as a separate isolation patient care unit.

A2.1-2.4.2.1 (3)(a) AII unit. Consider compartmenting patient spaces and/or units to develop a self-contained AII patient care unit.

a. *Entry/exit.* An entry/exit transition space, similar to that for a bone marrow transplant unit, should be provided for an isolation unit.

b. *Staff transition zone.* Consider providing a defined staff entry/egress point into each isolation unit for donning

PPE and hand-washing. Consider locating staff lockers and a changing area so they are readily accessible to the staff transition zone.

(b) When determined by an ICRA or the health care organization's disaster, emergency, and vulnerability assessment, a designated patient care unit or portion of a patient care unit shall be designed as an airborne infection isolation unit or sub-unit.

2.1-2.4.2.2 AII room requirements. Each airborne infection isolation room shall comply with the requirements in sections 2.1-2.2 (Patient Room) and 2.2-2.2.2 (Medical/Surgical Patient Care Unit: Patient Room) as well as the following requirements:

(1) Capacity. Each AII room shall contain only one bed.

(2) PPE storage. Provision shall be made for personal protective equipment (PPE) storage at the entrance to the room.

(3) Hand-washing station. Section 2.1-2.2.5.3 (Hand-washing station in the patient room—Renovation) shall not apply to AII rooms.

(4) Patient toilet room

(a) The patient toilet room shall serve only one AII room.

(b) ~~(5)~~ The patient toilet room shall have a bathtub or shower.

(5) Door. A door from the AII room directly to the corridor shall be permitted.

*(6) Means for communication

(a) The design of AII rooms shall provide for verbal and visual communication between patient and staff without the staff member having to be in the room with the patient.

(b) Doors that open directly into the AII room, either from the corridor or from the anteroom, shall have a view panel that allows staff to see the patient.

A2.1-2.4.2.2 (6) Means for communication in an AII room. The goal is to reduce the number of times staff must enter a patient room, reducing exposure to airborne disease as well as the need to don and doff PPE. One solution is to provide windows so staff can maintain visual contact with the patient. Verbal communication can be achieved with a nurse call system, cellular phones, or other electronic means.

2.1-2.4.2.3 Anteroom~~.~~

(1) Whether an ~~An~~ anteroom is ~~not~~ required shall be determined by the infection control risk assessment (ICRA). See Section 1.2-4.2.2.1 (2) (ICRA Considerations—Design elements) for requirements. ~~; however, where~~

(2) Where an anteroom is provided, it shall meet the following requirements:

(a) ~~(1)~~ The anteroom shall provide space for persons to don personal protective equipment (PPE) before entering the patient room and doff PPE before leaving.

(b) ~~(2)~~ All doors to the anteroom shall have self-closing devices or an audible alarm arrangement that can be activated when the AII room is in use as an isolation room.

(c) ~~(3)~~ The anteroom shall be equipped with at least the following:

(i) ~~(a)~~ Hand-washing station

(ii) ~~(b)~~ Storage for unused PPE

(iii) ~~(c)~~ Disposal/holding container for used PPE

2.1-2.8 Support Areas for Patient Care Units and Other Patient Care Areas…

2.1-2.8.7 Hand-Washing Station

***2.1-2.8.7.1 Location**

(1) Hand-washing stations shall be provided in each room where hands-on patient care is provided.

(2) For location and number requirements, see other common element sections in this chapter and the facility chapters.

> **A2.1-2.8.7.1** Consideration should be given to providing hand sanitation stations in all meeting rooms or education/training rooms to support infection prevention during a pandemic or epidemic.

***2.1-2.8.10 Ice-Making Equipment**

> **A2.1-2.8.10 Noise from ice-making equipment.** The location of and space for ice-making equipment in a patient care unit should be designed to mitigate noise. This can be achieved through various means, including considering its placement in relation to patient rooms or locating it in an enclosed space. See Table 1.2-6 (Design Criteria for Minimum Sound Isolation Performance Between Enclosed Rooms) for information about sound for patient rooms.

~~**2.1-2.8.10.1** In public areas, a~~ All ice-making equipment shall be of the self-dispensing type.

~~**2.1-2.8.10.2** In areas restricted to staff only, use of storage bin-type equipment for making and dispensing ice shall be permitted.~~

2.1-2.8.11 Clean Workroom or Clean Supply Room

*2.1-2.8.11.1 General. The clean workroom or clean supply room shall be separate from and have no direct connection with the soiled workroom or soiled holding room.

A2.1-2.8.11.1 If more than one clean workroom or clean supply room is provided in a patient care unit, consideration should be given to locating one of them so restocking/resupply can be performed without entering the unit. A room with a door that opens into the unit and another door that opens into the corridor outside the unit would serve this purpose.

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*2.1-2.8.12 Soiled Workroom or Soiled Holding Room

A2.1-2.8.12 Functions for soiled workroom and soiled holding room

a. *Soiled workroom.* Soiled items may be handled in a soiled workroom to prepare them for subsequent cleaning, disposal, or reuse (e.g., emptying and rinsing bedpans or emesis basins, emptying or solidifying suction canisters, rinsing and gross cleaning of medical instruments). As well, this room provides temporary storage for soiled items prior to their removal from the unit.

b. *Soiled holding room.* This location is used exclusively for temporary storage of soiled materials and/or supplies prior to their removal from the unit.

*2.1-2.8.12.1 General. Soiled workrooms and soiled holding rooms shall be separate from and have no direct connection with either clean workrooms or clean supply rooms.

A2.1-2.8.12.1 Soiled workrooms/holding rooms. If more than one soiled workroom or soiled holding room

is provided in a patient care unit, consideration should be given to locating one of them so removal of materials and equipment can be accomplished without entering the unit.

2.1-2.8.13.1 Clean linen storage. This storage shall meet the following requirements:

(1) Clean linen shall be permitted to be stored in the clean workroom, in a separate closet, or using a covered cart distribution system on each floor.

*(2) Where a covered cart distribution system is used, storage of clean linen carts in a corridor alcove shall be permitted.

A2.1-2.8.13.1 (2) In an AII patient care unit, clean supplies of any type—including linen—should not be kept in alcoves exposed to general unit circulation, regardless of cart type.

2.1-2.8.14 Environmental Services Room

2.1-2.8.14.1 General

*(1) Application. One environmental services room shall be permitted to serve more than one patient care unit on a floor.

A2.1-2.8.14.1 (1) Limiting an environmental services room to serving one patient care unit will provide greater ability to isolate the unit if required during a pandemic or other emergency condition.

*(2) Location. An environmental services room shall be readily accessible to the unit or floor it serves.

A2.1-2.8.14.1 (2) Environmental services room. Some departments or areas may need individually assigned environmental services rooms. Examples include:

—Patient care units

—Clinical areas: Pre- and post-procedure patient care areas, examination rooms, blood draw areas, dialysis treatment areas, infusion areas, and other areas likely to come into contact with blood or body fluids

—Sterile areas: Operating rooms, corridors in the semi-restricted area of the surgery suite, sterile labs, and sterile storage

—Endoscopy services rooms: Endoscopy procedure room and endoscope processing room

—Public and administrative areas: Waiting areas, offices, and hallways

—Compounding pharmacy

—Any functional areas identified as potential surge spaces by the disaster, emergency, and vulnerability assessment

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***2.1-2.9 Support Areas for Staff**

A2.1-2.9 Support areas for staff

a. *Location.* Support areas for staff should be restricted from public access as defined in section 02: Buildings and the Internal Environment in the IAHSS *Security Design Guidelines for Healthcare Facilities*. Wherever possible, staff lounge facilities should have access to daylight and views of the outdoors.

b. *Staff shower room.* Staff showers should be provided, either on all patient care units or shared between units or services. These showers are intended to accommodate staff who may have to stay at the hospital for several days during an emergency event or who desire to wash

up prior to exiting the facility to moderate potential infectious exposure of the general public.

c. ~~b.~~ *Staff rest areas.* Staff rest areas should be provided for every unit that has overnight patient care activities....

***2.1-2.9.1 Staff Lounge Facilities**

Lounge facilities of no less than 100 square feet (9.29 square meters) shall be provided.

A2.1-2.9.1 Designation of separate areas for activity and quiet respite is recommended.

2.1-2.9.2 Staff Toilet Room...

2.1-2.9.3 Staff Storage Facilities...

2.1-3.2 Examination Room or Emergency Department Treatment Room

2.1-3.2.1 General

...

2.1-3.2.1.3 Building system components. See the following tables for exam room requirements:

(1) Table 2.1-1 (Electrical Receptacles for Patient Care Areas in Hospitals)

(2) Table 2.1-2 (Locations for Nurse Call Devices in Hospitals)

(3) Table 2.1-3 (Station Outlets for Oxygen, Vacuum, Medical Air, and Instrument Air Systems in Hospitals)

2.1-3.2.1.4 Telemedicine. All examination rooms shall meet the requirements in Section 2.1-3.3 (Accommodations for Telemedicine Services).

2.1-3.2.1.5 Features to support isolation of patients. At least one examination room per medical specialty shall be entered through an anteroom and shall have HVAC design equal to that for an airborne infection isolation (AII) room.

2.1-3.2.4 Sexual Assault Forensic Examination Room

Where a sexual assault forensic examination room is provided, it shall meet the requirements in Section 2.1-3.2.2 (Single-Patient Examination or Treatment Room) and the following:

...

2.1-3.2.4.3 The room shall have ventilation controls to convert the room to negative pressure.

***2.1-3.2.5 Acuity-Adaptable Examination Room**

Where an acuity-adaptable examination room is provided, it shall meet the requirements in Section 2.1-3.2.2 (Single-Patient Examination or Treatment Room) as amended in this section:

> **A2.1-3.2.5 Acuity-adaptable examination room.** These rooms are intended to accommodate high-acuity patients or to house two beds or three recliners when needed for surge capacity.

2.1-3.2.5.1 General

(1) Number. The number of acuity-adaptable examination rooms of each type to be provided in a facility shall be determined by the expected patient population and services to be provided.

(2) An exam room designed for an individual of size [see Section 2.1-2.3.7 (Accommodations for Care of Patients of Size—Single-Patient Examination or Treatment Room)] shall be permitted to serve as an acuity-adaptable room if it meets the ventilation requirements in this section.

2.1-3.2.5.2 Space requirements

(1) Area. Acuity-adaptable rooms shall be sized to accommodate two patients.

(2) Clearances. Room size shall permit a room arrangement with the following minimum clearances when the room is used as a single-patient examination room:

(a) 3 feet 6 inches (1.07 meters) on the provider side

(b) 5 feet (1.52 meters) on the transfer side

(c) 4 feet (1.23 meters) at the foot of the examination table

(d) 18 inches (45.72 centimeters) at the head of the bed

2.1-3.2.5.3 Ventilation. Acuity-adaptable exam rooms shall have switchable controls that allow conversion of the ventilation system from neutral pressure to either negative or positive pressure.

2.1-3.2.6 Airborne Infection Isolation (AII) Examination Room

2.1-3.2.6.1 General

(1) The need for an AII exam room shall be determined by an ICRA.

(2) At least one AII exam room per medical specialty shall be entered through an anteroom.

2.1-3.2.6.2 AII exam room requirements. Where an AII exam room is provided, it shall meet the requirements in the following sections:

(1) Section 2.1-3.2.2 (Single-Patient Examination or Treatment Room)

(2) Section 2.1-2.4.2.1 (1) (AII Room—General)

(3) Section 2.1-2.4.2.3 (Anteroom)

(4) Section 2.1-2.4.2.4 (1) (AII Room—Architectural details)

(5) Section 2.1-2.4.2.5 (Pressure alarm)

***2.1-3.3 Accommodations for Telemedicine Services**

A2.1-3.3 Patient experience. Remote communications via electronic equipment, although not a replacement for in-person care, may be offered as a supplement where in-person care is not available or medically necessary. To assist in the adoption of telemedicine and maximize its benefits for elderly patients, those unaccustomed to electronic communication, and those with vision, hearing, or cognitive impairments, care should be given to remove technological barriers and provide telemedicine endpoints that facilitate natural communication for the widest range of participants. Facilities and systems used for telemedicine communications should strive to maintain the level of safety, privacy, quality of care, and patient experience that would be expected for in-person communication.

***2.1-3.3.1 General**

Where clinical telemedicine services are provided in a health care facility, telemedicine spaces to accommodate those services shall meet the requirements in this section.

A 2.1-3.3.1 Telemedicine service types

a. Services may include one-on-one interactions, consultations with a patient and family members (e.g., pediatric or elderly patients), examinations supported by a telemedicine presenter located with the patient, or specialty services such as dermatology or orthopedics. Each type of service may have specific needs for lighting and space to support the clinical function; for example, evaluation of patient gait requires unobstructed space to walk from one end of the bay, cubicle, or room to the other. Therefore, to achieve a functional design, it is important to know what services will be provided.

b. The requirements in this section are not intended to apply to virtual visits that do not require a physical examination of the patient or visits that originate from a physician's or patient's home.

***2.1-3.3.2 Telemedicine Bay, Cubicle, or Room**

A bay, cubicle, or room shall be provided for telemedicine services.

A2.1-3.3.2 Design considerations for telemedicine. Any space that is HIPAA-compliant is suitable as a telemedicine health care provider environment. Following are recommendations for the telemedicine patient environment:

a. *Equipment*

—Camera placement should be set so recipients perceive the exchange as happening eye-to-eye. The discrepancy between gaze angle should be minimal.

—Temperature control should be considered based on the amount of electronic equipment that may generate significant amounts of heat.

—Depending on the complexity of equipment used, multiple outlets may be required for equipment. Outlets should be located near the unit to avoid wires/cables on the floor.

b. *Architectural details*

—Doors in view of the main camera should be able to be closed to assure maximum privacy during the telemedicine appointment.

—Placement of doors behind the patient should be avoided as this can make patients uncomfortable.

2.1-3.3.2.1 General

(1) A bay, cubicle, or room where clinical telemedicine services are provided shall meet the requirements of the section of the *Guidelines* that directly relates to the services provided and the patient population served.

(2) Where patient volume does not justify provision of a dedicated telemedicine room, the telemedicine room shall be permitted to serve other functions such as physician's office, exam room, or conference room.

(3) Locations where clinical telemedicine services are provided shall include capability for remote monitoring of vitals and pumps, etc., from staff stations.

2.1-3.4 Pre- and Post-Procedure Patient Care

2.1-3.4.1 General...

2.1-3.4.2 Patient Care Station Design

2.1-3.4.2.1 General

(1) Bays, cubicles, or single-patient rooms that meet the requirements in this section shall be permitted to serve as patient care stations.

(2) Pre- and post-procedure patient care stations shall be designed in pods that can be independently accessed and managed, including access to building system elements.

(3) Space shall be provided around the perimeter of the pre- and post-procedure patient care area that can be converted into an area for donning and doffing of personal protective equipment when needed.

2.1-3.4.2.2 Space requirements

(1) Area. When determining the area for a patient care station, space needed for equipment shall be identified.

*(2) Clearances

A2.1-3.4.2.2 (2) Clearances in patient care stations

a. Two bays may be used to accommodate non-standard equipment (e.g., an expanded-capacity patient bed), but clearances do not include any area that would have to be shared to meet the standard. Clearances noted around gurneys are between the normal use position of the gurney and any adjacent fixed surface or between adjacent gurneys.

b. Sizing all pre- and post-procedure patient care stations with the largest clearances is recommended to provide flexibility for use during an emergency or for unanticipated future uses.

(a) Where bays are used, the following minimum clearances shall be provided:

(i) 5 feet (1.52 meters) between the sides of patient beds/ gurneys/lounge chairs

(ii) 3 feet (91.44 centimeters) between the sides of patient beds/gurneys/lounge chairs and adjacent walls or partitions

(iii) 2 feet (60.96 centimeters) between the foot of patient beds/gurneys/lounge chairs and the cubicle curtain

(b) Where cubicles are used, the following minimum clearances shall be provided:

(i) 3 feet (91.33 centimeters) between the sides of patient beds/gurneys/lounge chairs and adjacent walls or partitions

(ii) 2 feet (60.96 centimeters) between the foot of patient beds/gurneys/lounge chairs and the cubicle curtain

(iii) Where bays or cubicles face each other, an aisle with a minimum clearance of 8 feet (2.44 meters) independent of the foot clearance between patient stations or other fixed objects shall be provided.

(c) Where single-patient rooms are used, 3 feet (91.44 centimeters) shall be provided between the sides and foot of beds/gurneys/lounge chairs and adjacent walls or partitions.

2.1-3.4.2.3 Provisions shall be made for the isolation of infectious patients.

(1) An airborne infection isolation (AII) room is not required in pre- and post-procedure patient care areas.

(2) Provisions for the recovery of a potentially infectious patient with an airborne infection shall be determined by an infection

control risk assessment (ICRA). The ICRA shall determine requirements for the following:

(a) Percentage of pre- and post-procedure patient care areas to be provided with controls to convert the area to negative pressure

(b) Percentage of patient care stations that are AII-ready single-patient rooms, including an anteroom or space for a portable anteroom, in pre- and post-procedure patient care areas

2.1-3.4.2.4 Patient privacy. Provisions shall be made for patient privacy in accordance with Section 2.1-2.1.2 (Patient Privacy).

2.1-3.4.2.5 Hand-washing stations. See Section 2.1-2.8.7 (Hand-Washing Station) for requirements.

***2.1-3.4.2.6 Other design requirements**

A2.1-3.4.2.6 Equipment monitoring. Patient care station design should support use of equipment capable of remote monitoring of patient vitals, including blood oxygen saturation (SPO), and of pumps and other medical equipment. When the patient care station is a single-patient room, at minimum the equipment should be visible from outside the room through a window or view panel.

(1) For electrical receptacle requirements, see Table 2.1-1 (Electrical Receptacles for Patient Care Areas in Hospitals).

(2) For nurse call requirements, see Table 2.1-2 (Locations for Nurse Call Devices in Hospitals).

(3) For oxygen and vacuum requirements, see Table 2.1-3 (Station Outlets for Oxygen, Vacuum, Medical Air, and Instrument Air Systems in Hospitals).

2.1-4.1 Laboratory Services

...

2.1-4.1.3 Specimen Collection Facilities

2.1-4.1.3.1 General

(1) Space shall be provided for specimen collection.

*(2) Specimen collection facilities shall be permitted to be outside the laboratory work area.

> **A2.1-4.1.3.1 (2) Alternate specimen collection sites.** Planning for emergency conditions should include consideration of what is needed in the physical environment to support specimen collection sites located in the lobby and outside the facility, possibly in tents or parking structures.

2.1-4.2 Pharmacy Services…

***2.1-4.2.2 Pharmacy Areas**

> **A2.1-4.2.2 Security.** Pharmacies should be considered vulnerable areas during emergencies, including times of civil unrest. Whether or not a pharmacy contains narcotics, intruders could be seeking medications. Although pharmacies located inside a hospital may be relatively secure from intruders, possible increased security needs for emergency conditions should be considered.
>
> Security recommendations include providing bulletproof glass in pharmacy transaction windows and perimeter security features such as full-height walls with anti-breach measures (e.g., plywood, security mesh). External windows should be given the same considerations.

2.1-4.2.8 Support Areas for the Pharmacy...

***2.1-4.2.8.2 Office.** A separate room or area shall be provided for office functions.

A2.1-4.2.8.2 Office.

a. When sizing this room, consider the space needed to accommodate a desk, filing capabilities, communication equipment, and reference materials.

b. Consider providing data outlets and sound attenuation to support increased consultation regarding medications during an emergency condition.

2.1-4.2.8.3 A room for education and training. A multipurpose room shared with other departments shall be permitted to serve this purpose.

***2.1-4.2.8.4 Outpatient medication consultation area.** If medication is dispensed to outpatients from the hospital pharmacy, an area for consultation and patient education shall be provided.

A2.1-4.2.8.4 Considerations for medication consultation during emergency conditions. Consider providing data outlets and sound attenuation to support increased consultation regarding medications that may become necessary during an emergency condition. Because consultation often requires face-to-face communication, configurations to support safe interaction with an infectious patient should be considered.

2.1-4.3 Food and Nutrition Services

2.1-4.3.1 General

*2.1-4.3.1.1 **Application.** Facilities and equipment shall be provided to support food services provided for staff, visitors, and patients.

A2.1-4.3.1.1 Food services

a. *Typical food services.* Food service in a hospital may be provided in special dining areas (e.g., a physicians' dining room, conference center, boardroom, training facilities) and in retail serving areas for staff, ambulatory patients, and visitors. In addition, snacks between scheduled meals may be provided.

b. *Food service considerations for emergency conditions.* As dining is a key component of ongoing operations even during emergency conditions, the food service supply chain and storage capacity and corresponding ability to support meals for caregivers, patients, and the public during an emergency condition should be reviewed as part of the disaster, emergency, and vulnerability assessment. Physical environment supports needed for provision of continuous food service during an emergency should be determined.

2.1-4.3.2 Food Preparation Areas…

2.1-4.3.2.5 Hand-washing stations

(1) Hand-washing stations shall be provided within 20 feet (6.10 meters) of each food preparation or serving area.

(2) Hand-washing stations may be shared between adjacent food preparation stations.

(3) Hand-washing stations shall be located to eliminate the need to reach, touch, or cross over to a hand-washing station at another food preparation area.

***2.1-4.3.5 Dining Areas**

A2.1-4.3.5 Alternate uses of dining areas during an emergency condition. During a natural disaster or other emergency condition, dining areas may need to be repurposed to non-food service uses such as emergency care or inpatient care. Therefore, project planning should include consideration of the features and services (e.g., medical gases, power, privacy, HVAC controls) that would be required for such an alternate use arrangement to be functional. In addition, use of movable seating and tables in dining areas should be considered to facilitate provision of additional space when needed.

2.1-4.3.5.1 Dining space(s) shall be provided for ambulatory patients, staff, and visitors.

2.1-4.3.5.2 A minimum aisle spacing and chair clearance of 3 feet (91.5 centimeters) shall be provided, but it shall be expandable to accommodate physical distancing as needed during an infectious disease event.

2.1-4.3.5.3 The design of aisles, tables/chairs, and casework used for self-service shall accommodate wheelchair access. See Section 1.1-4.1 (Design Standards for Accessibility).

2.1-4.3.8.13 Food and supply storage…

(2) Refrigeration equipment

(a) Refrigeration equipment shall be on an uninterruptible power source.

~~(a)~~ (b) Refrigerators and freezers shall be thermostatically controlled to maintain temperature settings in increments of 2 degrees or less.

~~(b)~~ (c) Commercial-grade refrigeration shall be provided to hold chilled and frozen food at temperatures in accordance with local, state, and federal requirements, including "HACCP [Hazardous Analysis Critical Control Point] Principles & Application Guidelines" and the FDA "Food Code."

…

(4) Emergency storage. The following shall be provided ~~as~~ for 96 hours or additional time as determined in the design phase:

(a) Storage space to hold water and food to feed the entire patient and staff population, along with their families

~~(a)~~ (b) Storage for ~~emergency or disaster food~~ disposable dishes, cutlery, and trays

(c) Storage for personal protective equipment needed by food service staff

~~(b)~~ (d) Emergency utility support for refrigerated storage and food preparation and serving areas

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***2.1-5.3 Materials Management…**

2.1-5.3.3 Central Storage Facilities

***2.1-5.3.3.1 General**

(1) In addition to supply storage facilities located in individual departments, a central facility for general storage shall be provided.

(2) Location of central storage facilities in a separate building on-site shall be permitted as long as provisions are made for protection against inclement weather during transfer of supplies to the hospital.

(3) The impact of disasters on available supplies caused by product shortages and other supply chain interruptions shall be considered when sizing facility storage.

A2.1-5.3.3.1 Supplies for emergencies. During planning for central storage facilities, consideration for storage of emergency preparedness supplies, linens, etc., should be included. Emergency preparation storage may be located off-site provided a transportation plan is in place for accessing the supplies.

Health care organizations should carefully consider disaster risk factors for each location, structure, and supply path when designing storage facilities to ensure supply continuity in an emergency. Additional considerations include a connection to the essential electrical system for storage facilities, location of floodplains, and the structural integrity of warehouses and bridges, overpasses, and other structures along the supply path.

2.1-5.7 Morgue Services...

2.1-5.7.2 Autopsy Facilities

If autopsies are performed in the hospital, the following elements shall be provided:

***2.1-5.7.2.1 Refrigerated facilities for body holding.** Body-holding refrigerators shall be equipped with temperature-monitoring and alarm signals that annunciate at a 24-hour staffed location.

A2.1-5.7.2.1 Consideration should be given to placing body-holding refrigerators on the essential electrical system.

2.1-6 Public and Administrative Areas

*2.1-6.1 General

A2.1-6.1 Public and administrative areas are those non-patient care areas where the public is received into the hospital and where administrative functions in support of hospital operations take place.

These areas should be designed with consideration for security principles involving zones of protection as defined in Section 02: Buildings and the Internal Environment in the IAHSS *Security Design Guidelines for Healthcare Facilities*. As well, during project planning and design, means for supporting a one-way path of travel for those entering the facility during a pandemic or mass casualty event should be identified.

2.1-6.1.1 Application

Where required by the facility chapters, public and administrative areas shall be designed according to the requirements in Section 2.1-6 (Public and Administrative Areas).

2.1-6.1.2 Location

Public areas shall be clearly identified and located to accommodate persons with disabilities.

2.1-6.2 Public Areas

The following shall be provided:

*2.1-6.2.1 Vehicular Drop-Off and Pedestrian Entrance

A2.1-6.2.1 Climate, patient acuity, and community standards may influence whether a covered or canopied entrance is desired.

2.1-6.2.1.1 A minimum of one drop-off or entrance shall be reachable from grade level.

2.1-6.2.1.2 Where the vehicular drop-off and pedestrian entrance will be used for outdoor staging during an emergency condition, see Section 2.1-8.1.3.1 (2) (Building System Considerations for Emergency Conditions—General) for building system requirements.

2.1-6.2.1.3 Means for an alternate point of access for potentially infectious patients shall be provided.

2.1-6.2.2 Reception Area or Lobby

2.1-6.2.2.1 This space shall include the following:

(1) Access to information

(2) Public waiting area(s)

(3) Public toilet room(s)

(4) Provisions for telephone access

(5) Provisions for drinking water

(6) Outlets for charging cell phones and mobile devices

2.1-6.2.2.2 Emergency provisions. The following accommodations for emergency response shall be located in or readily accessible to the reception area or lobby:

(1) Sanitizing stations

(2) Power/data ports for deployment of temporary scanners and other equipment

(3) Signage or other cues indicating changes in patient, staff, and visitor flow

(4) Storage for screening equipment

2.1-6.2.2.3 ~~**2.1-6.2.2.2**~~ Shared lobbies shall be permitted in multi-occupancy buildings.

2.1-6.3 Administrative Areas...

2.1-6.3.4 Multipurpose Room

2.1-6.3.4.1 Several services or departments shall be permitted to share one multipurpose room.

2.1-6.3.4.2 Shared use of an office or interview room for this purpose shall be permitted.

2.1-6.3.4.3 Multipurpose rooms shall be designed for conversion to a staff respite space, space for donning and doffing personal protective equipment, a control center, or other use during an emergency as determined by a disaster, emergency, and vulnerability assessment.

2.1-6.4 Support Areas for Staff and Volunteers

2.1-6.4.1 Lockers, lounges, showers, and toilets shall be provided for employees and volunteers.

2.1-6.4.2 Lockers, lounges, showers, and toilets for staff shall be separate from those provided for the public.

2.1-7 Design and Construction Requirements…

2.1-7.2.2.3 Doors and door hardware. Door and door hardware finishes shall be selected to withstand impact damage and cleaning with EPA-registered hospital disinfectants.

*(1) Door type

A2.1-7.2.2.3 (1) Hands-free doors. Patients, caregivers, and visitors should be able to open doors without using their hands.

(a) All doors between corridors, rooms, or spaces subject to occupancy shall be of the swing type or shall be sliding doors.

*(b) Sliding doors

A2.1-7.2.2.3 (1)(b) Sliding doors. Use of sliding doors rather than swing doors is highly recommended for airborne infection isolation rooms, protective environment rooms, and other spaces for which an ICRA has identified infection control as an issue. Research has shown that swinging door motion induces up to six times more possible contaminates than sliding door motion and can significantly affect contaminant control.

(i) Use of manual or automatic sliding doors shall be permitted where fire and other emergency exiting requirements are not compromised.

(ii) Sliding doors with emergency breakaway features in the full open position shall be permitted to temporarily restrict the minimum corridor width required by applicable building codes.

*(iii) Sliding doors shall not have floor tracks.

A2.1-7.2.2.3 (1)(b)(iii) Eliminating floor tracks and using breakaway door hardware minimizes the possibility of jamming.

...

*(4) Door hardware~~. Lever hardware or push/pull latch hardware shall be provided.~~

(a) Where hands-on patient care will be provided, push/pull hardware shall be required.

(b) Lever hardware shall be permitted in all other locations.

A2.1-7.2.2.3 (4) Door protection should be provided where a door is subject to impact.

***2.1-7.2.2.8 Hand-washing stations**...

(5) Provisions for drying hands. Provisions for hand drying shall be required at all hand-washing stations (except hand scrub facilities).

(a) Hand-washing stations shall include a hand-drying device that does not require hands to contact the dispenser.

(b) These provisions shall be enclosed to protect against dust or soil and to ensure single-unit dispensing.

~~(c) Hot air dryers shall be permitted.~~

(c) ~~(d) Where provided, s~~ Single-use towels shall be provided ~~directly accessible to sinks~~ and located to prevent contact with splash from the sink.

***2.1-7.2.3 Surfaces**

A2.1-7.2.3 Characteristics and criteria for selecting surface and furnishing materials and products. The effect of surface materials, colors, textures, and patterns on patient, staff, and visitor safety and on maintenance and life cycle performance should be considered in the overall planning and design of the facility....

c. Patient safety risk assessment issues addressed by

surfaces and furnishings performance characteristics and criteria

—*Reduction of surface contamination linked to health care-associated infections (HAIs).* Surfaces and furnishings selected should have clear, written manufacturer-provided cleaning protocols that will ensure the product remains durable and can meet CDC cleaning standards for health care facilities.

- Verify that cleaning techniques in the manufacturer's use instructions for all surfaces are consistent with the cleaning products and techniques specified in the ICRA.
- Surfaces should be easy to clean, with no surface crevices, rough textures, joints, or seams.
- Surfaces should be non-absorptive, nonporous, and smooth.
- Manufacturer-recommended cleaning and disinfection methodologies should be easy to use and effective for meeting CDC and other clinical bacterial elimination requirements.

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*__2.1-7.2.4.3 Privacy curtains in patient rooms and other patient care areas.__ Use of fabric privacy curtains shall be permitted if the fabric is washable.

A2.1-7.2.4.3 Use of disposable curtains or a wipeable fabric with a smooth surface is preferable.

2.1-8 Building Systems

2.1-8.1 General

...

2.1-8.1.2 Surge Capacity Locations

In areas identified as surge capacity locations, medical gas outlets used to support surge capacity patient care shall be installed in a secured location or in a tamper-resistant housing.

2.1-8.1.2.1 The tamper-resistant housing shall be designed for quick removal or entrance by facility maintenance staff to provide full and complete access to inspect, maintain, and use the outlets.

2.1-8.1.2.2 The housing shall not violate the outlet or fixture manufacturer's recommendations.

2.1-8.1.2.3 The housing shall not obstruct or intrude into the means of egress.

2.1-8.1.3 Building System Considerations for Emergency Conditions

Where required by the disaster, emergency, and vulnerability assessment (DEVA), the following requirements shall be met:

2.1-8.1.3.1 General

(1) Patient bed headwalls shall be designed to meet power and medical gas requirements for more than one patient care station.

(2) Locations identified for outdoor staging during pandemic or mass casualty events shall have power, data, and water connections on the exterior of the building.

(3) Hookups shall be provided for temporary generators and supplemental bulk oxygen in a location accessible to emergency supply vehicles at all times.

2.1-8.1.3.2 HVAC systems

(1) Air-handling unit fans, filters, and coils shall be oversized so they can operate at 100 percent outdoor air in locations indicated in the DEVA.

(2) Patient rooms

(a) To allow conversion of the patient room to negative pressure, an exhaust grille shall be provided in the ceiling above patient beds to support unidirectional airflow or at the window.

(b) Ventilation systems serving standard patient rooms shall be designed so air changes per hour (ACH) can be increased on demand as indicated in the DEVA.

(3) Negative pressure examination/treatment rooms

*(a) HVAC design shall permit switching the examination/treatment room pressure relationship to negative.

A2.1-8.1.3.2 (3)(a) Negative pressure examination/treatment room. Control of the switch to a negative pressure relationship can be accomplished using a local pressure monitor key switch, the building automation system, or a keypad device.

(b) HEPA filtration and/or 100 percent outside air shall be installed in conjunction with the negative pressure control settings.

(4) HVAC design shall provide the ability to convert final filters to HEPA filters.

(5) HVAC systems shall be designed to change from return air to exhaust air for designated areas when needed. A separate exhaust system, including exhaust fan with motorized dampers, shall be provided to close the return air path when a specific location is being exhausted.

2.1-8.3.4 Lighting…

2.1-8.3.4.3 Lighting for specific locations in the hospital

*(1) Patient rooms. Patient rooms shall have general lighting and night-lighting.

> **A2.1-8.3.4.3 (1) Hands-free lighting controls.** Hands-free functionality is preferable for lighting controls when this feature is available for light fixtures chosen. The goal is to avoid high-touch locations that might become transmission vectors for spreading infection.

(a) Lighting for reading shall be provided for each patient bed.

(i) Reading light controls shall be accessible to the patient(s) without the patient having to get out of bed.

(ii) Incandescent and halogen light sources that produce heat shall be placed or shielded to protect the patient from injury.

(iii) Unless the light source is specifically designed to protect the space below, the light source shall be covered by a diffuser or lens.

(iv) Flexible light arms, if used, shall be mechanically controlled to prevent the lamp from contacting the bed linen.

*(b) At least one night-light fixture shall be located in each patient room. This requirement does not apply to critical care patient rooms where view panels are provided to the corridor.

A2.1-8.3.4.3 (1)(b) Night-lighting

a. Night-lights with lamps that have a warm-up time or

a delay in reaching the intended light level should be avoided.

b. The night-light should be mounted on the wall near the floor to avoid disturbing the patient.

*(i) Central control of night-lights such as a common switch at the nurse station or time clock shall be prohibited.

A2.1-8.3.4.3 (1)(b)(i) The night-light should be controlled at the room entrance. Night-long use of night-lights is typically patient dependent. Some patients prefer dark rooms and are disturbed by night-lights. Patient control of the night-light may also be provided via three-way switching or low-voltage controls.

*(ii) The night-light shall be located for staff and patient use to illuminate both the path from the room entrance to the bedside and the path between the bed and the toilet room.

A2.1-8.3.4.3 (1)(b)(ii) Indirect lighting should be provided to reduce glare on surfaces to accommodate vision issues for patient comfort.

(c) Lighting for critical care bed areas shall permit staff observation of the patient while minimizing glare.

2.1-8.7.2 Elevators

***2.1-8.7.2.1 General.** Hospitals with patient facilities (e.g., patient rooms, dining rooms, recreation areas) or critical services (e.g., operating, delivery, diagnostic, therapeutic areas) located on floors other than the grade-level entrance floor shall have elevators.

A2.1-8.7.2.1 Consideration should be given to dedicating and separating elevator types by function, such as those for the public, patients, staff, and materials (e.g., clean vs.

soiled flows), as the diverse uses affect both operational efficiency and cross-contamination and infection control issues. Separating elevator functions may be necessary during emergency conditions (e.g., a pandemic).

2.1-8.7.2.2 Number

(1) At least two hospital-type elevators shall be installed where 1 to 59 patient beds are located on any floor other than the main entrance floor.

(2) At least two hospital-type elevators shall be installed where 60 to 200 patient beds are located on floors other than the main entrance floor, or where the major inpatient services are located on a floor other than those containing patient beds. (Reduction in elevator service shall be permitted for those floors providing only partial inpatient services.)

(3) At least three hospital-type elevators shall be installed where 201 to 350 patient beds are located on floors other than the main entrance floor, or where the major inpatient services are located on a floor other than those containing patient beds. (Reduction in elevator service shall be permitted for those floors providing only partial inpatient services.)

*(4) For hospitals with more than 350 beds, the number of elevators shall be determined from a study of the hospital plan and the expected vertical transportation requirements.

A2.1-8.7.2.2 (4) Methods for conducting a traffic study are described in George R. Strakosch and Robert S. Caporale, *Vertical Transportation Handbook*. Possible emergency events identified in the disaster, emergency, and vulnerability assessment should be included in all vertical transportation studies.

Chapter 2.2 Specific Requirements for General Hospitals

***2.2-2.2 Medical/Surgical Patient Care Unit…**

***2.2-2.2.2 Patient Room**

A2.2-2.2.2 Telemetry systems. Health care organizations should consider the addition of telemetry infrastructure in patient rooms to enable quick conversion to critical care during an emergency event. During emergency conditions, patient rooms may be converted to a higher acuity level to accommodate patient surge.

…

2.2-2.2.2.2 Space requirements

…

*(2) Clearances

(a) The dimensions and arrangement of rooms shall provide a minimum clearance of 3 feet (91.44 centimeters) between the sides and foot of the bed and any wall or other fixed obstruction.

(b) In multiple-patient rooms, a minimum clearance of 4 feet (1.22 meters) shall be available at the foot of each bed to permit the passage of equipment and beds.

A2.2-2.2.2.2 (2) Clearances for surge capacity. When designing medical/surgical patient rooms that can be converted to support an organization's ability to increase intensive care unit capacity, consider providing space to

accommodate clearances for two beds, including a 66-inch clearance on the transfer side of each bed.

...

***2.2-2.2.2.9 Infrastructure to support IV pumps and monitors.** Means shall be provided to locate IV pumps and monitors outside of patient rooms.

A2.2-2.2.2.9 Location of IV pumps and monitors outside patient rooms. During an epidemic, providing staff a means to monitor patients without entering the patient room supports the need to protect staff health and conserve personal protective equipment (PPE). The solution should include consideration of the location of a connection to the essential electrical system for monitors and IV pumps as well as fluid tubing from pumps or ventilators. The design should also make it possible to keep the required air balance in the patient room. A preferred solution would be a rated device (for applicable fire, smoke, acoustic, and air leakage requirements) installed through the wall for passage of the equipment cables and tubing.

2.2-3.1.3 Emergency Department

2.2-3.1.3.1 General

(1) Application. Hospitals that offer more than basic emergency care services shall have facilities that meet the requirements in this section for the services they provide.

(2) Security.

*(a) Perimeter security. The emergency department shall be designed to ensure that access control can be maintained at all times.

A2.2-3.1.3.1 (2)(a) Perimeter security. ~~**A2.2-3.1.3.3**~~
The exterior perimeter of the emergency department should have the capability to be secured to control access and provide safety in the event of a disaster or situations requiring a higher level of security.

(b) Means to detect weapons, such as a metal detector, shall be provided at each point of entry to the emergency department.

(c) A video surveillance system shall be provided for each emergency department entrance.

(d) Where entrances may be locked, a visible duress alarm system shall be provided.

*(3) Path of travel for infectious patients

A2.2-3.1.3.1 (3) Non-infectious and infectious patients are likely to be treated simultaneously, although the population percentages will vary by facility.

(a) Means to support a split-flow point of entry shall be provided to separate different patient populations (e.g., fever/influenza, enteric, non-infectious).

(b) A clear path of travel shall be provided for infectious patients arriving by ambulance either through the exterior decontamination facility or straight to the trauma/resuscitation room.

(c) The path of travel for infectious patients shall be a negative pressure environment that is 100 percent exhausted.

***2.2-3.1.3.3 Reception and triage areas**~~.~~

~~**A2.2-3.1.3.3** The exterior perimeter of the emergency department should have the capability to be secured to control access and provide safety in the event of a disaster~~

~~or situations requiring a higher level of security.~~ [Moved to A2.2-3.1.3.1 (2)(a).]

***2.2-3.1.3.6 Treatment room or area**

A2.2-3.1.3.6 Provision of all single-patient treatment rooms, rather than inclusion of some multiple-patient treatment areas, should be considered to help limit the potential for infection transmission. Even if these rooms are not designed as airborne infection isolation rooms, their use can provide the opportunity to separate airflow and enable focused cleaning of the space between patients.

Chapter 2.4 Specific Requirements for Critical Access Hospitals

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***2.4-1.3 Site**

A2.4-1.3 Flexible site considerations for emergency events. Provision of flexible open spaces that are strategically located on-site can support additional functional and programmatic needs that may be required during emergency events. To maximize functionality, design of a flexible site must factor in appropriate building system components (e.g., additional electrical receptacles, medical gas sources, communications equipment) to support potential added functions and programmatic requirements. In isolated, remote, or rural locations and urban locations with limited outside resources, support, or connectivity, the following should be considered:

a. Identification of on-site locations that can be used for disaster preparedness, response, and recovery. These

areas may include paved parking and roads, open canopy and garage structures, gravel laydown areas, mobile unit pads, future expansion areas, and loading docks. Ambulance bays or garages should not be considered for this purpose.

b. Provision of utility services to the identified locations for quick, convenient use when needed

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2.4-1.3.5 Hospital Incident Command System (HICS)

See Section 1.2-6.5.2 (Hospital Incident Command System) for requirements.

2.4-2.2 Critical Access Patient Care Unit…

2.4-2.2.2 Patient Room…

*__2.4-2.2.8.13 Equipment and supply storage.__ Equipment and supply storage shall be provided. For requirements, see Section 2.1-2.8.1.3 (Equipment and Supply Storage).

A2.4-2.2.8.13 Equipment and supply storage considerations for emergency events. An emergency event could disrupt the supply chain for items needed to support a surge event, including provision of patient care services. In isolated, remote, or rural locations and urban locations with limited outside resources, support, or connectivity, consider providing supplemental storage spaces—on-site or off-site, if easily accessible—to accommodate specialized needs prior to, during, and after a disaster event. Additional storage may be needed for items such as medical equipment (e.g., ventilators), medical gas cylinders, PPE, food, medical supplies, and generator diesel fuel.

2.4-3.2 Emergency Services…

***2.4-3.2.2 Additional Emergency Services Requirements**

A2.4-3.2.2 Space considerations. When performing a disaster, emergency, and vulnerability assessment, health care organizations should identify available flexible space in the facility. Space considerations include accommodations for:

a. Layout and clearances to accommodate one-way flow patterns

b. Segregation of patient populations during and after an emergency event

c. Potential adaptability of rooms or spaces to alternate functions during an emergency event (e.g., planning a patient room so it could function as a negative pressure room)

***2.4-8 Building Systems**

A2.4-8 See appendix section A2.4-1.3 (Flexible site considerations for emergency events) for building system considerations for flexible site use during an emergency condition.

***2.4-8.5.2 Telecommunications and Information Systems**

A2.4-8.5.2 Telecommunications and information systems considerations for disaster events

a. Consideration should be given to location, access,

availability, and placement of telecommunication and broadband access points (hard-wired and WiFi) to support flexibility prior to, during, and after a disaster event. Strategically locating telecommunication and broadband access points can support additional functional and programmatic requirements during an emergency event.

b. Surge locations identified during planning should have access to telecommunication and broadband access points so they can properly function as an extension of the facility and connect to outside support services.

c. See appendix section A2.4-1.3 (Flexible site considerations for emergency events) for parking and site planning considerations.

2.4-8.5.2.1 Location

(1) Locations for terminating telecommunications and information system devices shall be provided.

(2) Telecommunications distribution rooms (TDRs) and telecommunications equipment rooms (TECs) shall be located at an elevation above the 100-year floodplain and storm surge levels.

2.4-8.5.2.2 A central equipment space shall be provided that meets manufacturer requirements for the following:

(1) Temperature range

(2) Air filtration

(3) Humidity control

(4) Voltage regulation

Chapter 2.8 Specific Requirements for Mobile/ Transportable Medical Units

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2.8-1.1.1 Applicable Medical Units…

2.8-1.1.1.~~2~~3 ~~This~~ The requirements of this chapter shall not be applied to federally funded mobile/transportable medical units designed for and placed into service ~~as a result of~~ to respond to a civil or local emergency or catastrophe.

***2.8-1.1.1.~~3~~4** This chapter shall not be applied to modular/ relocatable medical units that are prefabricated off-site and finished on-site and transported to a permanent foundation. ~~on-site that cannot be readily moved.~~

***2.8-1.3 Site**

A2.8-1.3 Disaster planning. Health care organizations should consider the use of mobile and relocatable unit utilities and unit pads during a disaster event to allow space for additional patient care capacity in the facility.

Table 1.2-1: Safety Risk Assessment (SRA) Components

Assessment	Facility Type/ Area	Project Scope	*Guidelines* Reference
Infection control risk (ICRA)	All	1. New construction 2. All renovations	1.2-4.2
Patient handling and movement (PHAMA)	Areas where patient handling, transport, transfer, and movement occur	1. New construction 2. Major renovation and renovations changing functional use of space 3. Minor and minimal renovations where patient handling occurs	1.2-4.3
Fall prevention	Any area to which a patient or family member has access	1. New construction 2. Major renovation and renovations changing functional use of space 3. Minor and minimal renovations where patient falls may occur	1.2-4.4
Medication safety	Medication safety zones	1. New construction 2. Major renovation and renovations changing functional use of space 3. Minor and minimal renovations where medication preparation, processing, and distribution occurs	1.2-4.5
Behavioral and mental health risk	Any area where behavioral health patient care is provided	1. New construction 2. Major renovation and renovations changing functional use of space to include care of behavioral health patients 3. Minor and minimal renovations where behavioral health patient treatment occurs	1.2-4.6
Patient immobility	Inpatient locations	1. New construction 2. Major renovation and renovations changing functional use of space to inpatient use 3. Minor and minimal renovations where inpatient care occurs	1.2-4.7
Security risk	All	1. New construction 2. All renovations	1.2-4.8
Disaster, emergency, and vulnerability	All	1. New construction 2. Major renovation and renovations changing functional use of space	1.2-4.9

Appendix Table A1.2-a: Safety Risk Assessment Team Member Expertise

EXPERT	SAFETY COMPONENT							
	Infection control risk	Patient handling and movement	Fall prevention	Medication safety	Behavioral and mental health risk	Patient immobility	Security risk	Disaster, emergency, and vulnerability
Clinicians from services affected by the project	✓	✓	✓	✓	✓	✓	✓	✓
Facility management staff	✓	✓	✓	✓	✓	✓	✓	✓
Performance and/or quality improvement experts	✓	✓	✓	✓	✓	✓	✓	
Safety specialists	✓	✓	✓	✓	✓	✓	✓	✓
Security specialist(s)					✓		✓	✓
Infection preventionists	✓	✓		✓			✓	✓
Architects, interior designers, and/or engineers	✓	✓	✓	✓	✓	✓	✓	✓
Human factors specialists	✓	✓	✓	✓	✓	✓		
Emergency preparedness officer/ representative								✓
Risk manager	✓	✓	✓	✓	✓	✓	✓	✓
Insurance provider							✓	✓
Other appropriate individuals based on nature of the project	As needed	As needed	As needed	As needed	As needed	As needed	As needed	As needed

Table 2.1-1 Electrical Receptacles for Patient Care Areas in Hospitals

Section	Location	Number of Single Receptacles[1]	Receptacle Locations
PATIENT BED LOCATIONS			
2.1-2.4.2	All room[2]	12	2 at each side of the head of the bed 2 on all other walls 1 for a television, if used 1 for each motorized bed 1 dedicated for ventilator
2.2-2.2.2	Medical/surgical unit patient room[2]		
2.2-2.2.4.4	Protective environment room[2]		
2.2-2.5.2	Intermediate care unit patient room		
2.2-2.9.2.2	Postpartum unit patient room[2]		
2.2-2.11.2	Pediatric and adolescent unit patient room[2]		
2.6-2.2.2	Rehabilitation unit patient room		
2.2-2.6.2	Intensive ~~Critical~~ care unit (I~~C~~CU) patient room	16	Convenient[3] to head of bed with one on each wall 1 dedicated for ventilator
2.2-2.7.2	Pediatric intensive ~~critical~~ care unit patient room		
2.2-2.8.2	Neonatal intensive care unit (NICU) patient care station	16	Convenient[3] to head of bed with one on each wall
2.2-2.9.3	LDR/LDRP room	16	8 convenient[3] to head of mother's bed 1 dedicated for ventilator 4 convenient[3] to each bassinet with one on each wall

Table 2.1-1 Electrical Receptacles for Patient Care Areas in Hospitals *(continued)*

Section	Location	Number of Single Receptacles[1]	Receptacle Locations
DIAGNOSTIC AND TREATMENT AREAS			
2.1-3.2 Table 2.2-2	Examination room Class 1 imaging room	8	4 convenient[3] to head of gurney or bed or on each lateral side of the imaging gantry
2.2-2.9.11	Cesarean delivery room	304	16 convenient[3] to table placement 2 on each wall 6 in the infant care area
2.2-3.1.2.6	Treatment room for basic emergency services	12	Convenient[3] to head of gurney or bed
2.2-3.1.3.3	Triage room or area in the emergency department	6	Convenient[3] to head of gurney or bed (At least 50% of these outlets shall be connected to emergency system power and be so labeled.)
2.2-3.1.3.6 (2) and (3)	Emergency department treatment room	12	Convenient[3] to head of gurney or bed
2.2-3.1.3.6 (4)	Trauma/resuscitation emergency room	16	Convenient[3] to head of gurney or bed
2.2-3.2.2	Observation unit patient care station	8	4 convenient[3] to head of gurney or bed
2.2-3.3.2 Table 2.2-2	Procedure room (including endoscopy) Class 2 imaging room	12[4]	8 convenient[3] to table placement with at least one on each wall
2.2-3.3.3 Table 2.2-2	Operating room Class 3 imaging room	36[4]	16 convenient[3] to table placement 2 on each wall

Table 2.1-1 Electrical Receptacles for Patient Care Areas in Hospitals *(continued)*

Section	Location	Number of Single Receptacles[1]	Receptacle Locations
2.2-3.10.2	Hemodialysis patient care stations	8	4 on each side of a patient bed or lounge chair. (Two on each side of the bed shall be connected to emergency power.)
POST-ANESTHESIA CARE LOCATIONS			
2.1-3.4.4	Phase I post-anesthetic care (PACU) patient care station	8	Convenient[3] to head of gurney or bed
2.1-3.4.5	Phase II recovery patient care station	4	Convenient[3] to gurney, lounge chair, or bed

[1]Permanently installed single, duplex, or fourplex receptacles or a combination of these shall be permitted. Receptacles in relocatable power taps or mounted on portable equipment shall not be counted as part of the total minimum requirement.

[2]Omission of receptacles from exterior walls in patient rooms shall be permitted where construction or room configuration makes installation impractical.

[3]"Convenient" in this table means the cords from the equipment to be used in the room can reach the receptacles without causing a trip hazard.

[4]The number of receptacles for these spaces is intended to agree with the number required in the governing edition of NFPA 99: *Health Care Facilities Code*.

Notes

1. Consideration shall be given to providing some outlets on emergency power and some on normal power at the head of patient beds and in operating rooms, cesarean delivery rooms, and trauma/resuscitation emergency rooms in case of transfer switch failure.
2. Each patient bed location or procedure room shall be supplied by at least two branch circuits, one from the essential electrical system and one or more from the normal system. Critical care locations served from two separate transfer switches on the essential electrical system shall not be required to have separate circuits from the normal system.
3. Branch circuits serving only special purpose receptacles or equipment in critical care areas shall be permitted to be served by other panelboards.
4. An additional outlet shall be provided for a television if one is furnished in the room.

5. A minimum of one dedicated circuit shall be provided to each critical care patient location.

6. Open heart post-anesthesia recovery spaces require more receptacles than those specified in this table; the number should be determined during the planning phase.

Table 2.1-3 Station Outlets/Inlets for Oxygen, Vacuum (Suction), Medical Air, and Instrument Air Systems in Hospitals[1] [table excerpts]

Section	Location	Oxygen	Vacuum	Medical Air	WAGD[2]	Instrument Air
PATIENT CARE UNITS						
2.1-2.4.2	Airborne infection isolation (AII) room	1/bed[X]	1/bed[X]	—	—	—
2.2-2.2.2	Patient room (medical/surgical)	1/bed[X]	1/bed[X]	—[3]	—	—
2.2-2.2.4.4	Protective environment room	1/bed[X]	1/bed[X]	—	—	—
2.2-2.5.2	Intermediate care room	2/bed[X]	2/bed[X]	1/bed[X]	—	—
2.2-2.6.2	Critical care patient room	3/bed[X]	3/bed[X]	1/bed[X]	—	—
2.2-2.6.4.2	Critical care AII room					
2.2-2.7.2	Pediatric critical care room					
2.2-2.8.2	Neonatal intensive care unit (NICU) infant care bed	3/infant care bed	3/infant care bed	3/infant care bed	—	—

Table 2.1-3 Station Outlets/Inlets for Oxygen, Vacuum (Suction), Medical Air, and Instrument Air Systems in Hospitals[1] [table excerpts] *(continued)*

Section	Location	Oxygen	Vacuum	Medical Air	WAGD[2]	Instrument Air
2.2-2.9.2	Antepartum and postpartum unit	1/bed[X]	1/bed[X]	—	—	—
2.2-2.9.3	Labor/delivery/ recovery (LDR)					
2.2-2.9.3	Labor/delivery/ recovery/ postpartum (LDRP)					
2.2-2.9.11.1	Infant resuscitation space	3/ bassinet	3/ bassinet	3/ bassinet	—	—
2.2-2.9.11	Cesarean delivery room	2/room[X]	4/room[X]	1/room[X]	—	—
2.2-2.9.11.11	Recovery space for cesarean delivery	1/bed[X]	3/bed[X]	1/bed[X]	—	—
2.2-2.10.3.1	Newborn nursery	1/ bassinet[5]	1/ bassinet[5]	1/ bassinet[5]	—	—
2.2-2.10.3.2	Continuing care nursery	1/ bassinet	1/ bassinet	1/ bassinet	—	—
2.2-2.11.2	Pediatric and adolescent patient room	1/bed[X]	1/bed[X]	1/bed[X]	—	—
DIAGNOSTIC AND TREATMENT LOCATIONS						
2.1-3.2	Examination room or emergency department treatment room	1/room[X]	1/room[X]	—	—	—

Table 2.1-3 Station Outlets/Inlets for Oxygen, Vacuum (Suction), Medical Air, and Instrument Air Systems in Hospitals[1] [table excerpts] *(continued)*

Section	Location	Oxygen	Vacuum	Medical Air	WAGD[2]	Instrument Air
2.1-3.4.4	Phase I post-anesthesia (PACU) patient care station	2/ station[X]	3/ station[X]	1/ station[X]	—	—
2.1-3.4.5	Phase II recovery patient care station	1/ station[X]	1/ station[X, 6]	—	—	—
2.2-3.1.2.6	Treatment room for basic emergency services	1/ gurney[X]	1/ gurney[X]	—	—	—
2.2-3.1.3.3	Triage area (emergency department)	1/ station[X]	1/ station[X]	—	—	—
2.2-3.1.3.6	Emergency department treatment room or area	1/ gurney[X]	1/ gurney[X]	1/ gurney[X]	—	—
2.2-3.1.3.6 (4)	Trauma/ resuscitation room	2/ gurney[X]	3/ gurney[X]	1/ gurney[X]	—	—
	Plaster and cast room	1/room[X]	1/room[X]	—	—	—
2.2-3.2.2	Observation unit patient care station	1/ station[X]	1/ station[X]	—	—	—
Table 2.2-2	Class 1 imaging room	1/room[X]	1/room[X]	—	—	—

Table 2.1-3 Station Outlets/Inlets for Oxygen, Vacuum (Suction), Medical Air, and Instrument Air Systems in Hospitals[1] [table excerpts] *(continued)*

Section	Location	Oxygen	Vacuum	Medical Air	WAGD[2]	Instrument Air
2.2-3.3.2 Table 2.2-2	Procedure room Class 2 imaging room	2/room[X]	2/room[X]	1/room[X]	—	—
2.2-3.3.3 Table 2.2-2	Operating room Class 3 imaging room	2/room[X]	5/room[X]	1/room[X]	1/room	1/room
2.2-3.11.2	Endoscopy procedure room	1[X]	3[X]	—	—	—
2.2-3.11.3	Endoscopy pre- and post-procedure patient care area	0[X,7]	0[X,7]	—	—	—
2.2-3.13.4	Hyperbaric suite pre-procedure patient care area	2[X]	2[X]	—	—	—
2.5-3.4.2.2	Electroconvulsive therapy treatment room	1[X,9]	1[X,9]	—	—	—

[1]For any area or room not included in this table, the facility clinical staff shall determine station outlet requirements after consultation with the authority having jurisdiction.

[X]Provision of an additional station outlet shall be considered to accommodate ventilator use during an emergency condition and future equipment that may require more access to medical gases.

[2]WAGD stands for "waste anesthesia gas disposal" system.

[3]Medical air outlets may be required in patient rooms.

[4]When infant resuscitation takes place in a room such as a cesarean delivery room or an LDRP room, infant resuscitation services must be provided in that room in addition to the minimum service required for the mother.

[5]Four bassinets may share one outlet that is accessible to each bassinet.

[6]If the Phase II recovery area is combined with the PACU, three vacuum outlets per bed or station shall be provided.

[7]A portable source shall be available for the space.

[8]Vacuum and/or instrument air shall be provided if needed for the cleaning methods used.

[9]Use of portable equipment in lieu of a piped gas system shall be permitted.

[10]In the one-room sterile processing facility and the clean workroom of the two-room sterile processing facility, an instrument air outlet or portable compressed air shall be provided as required by the equipment used. In the decontamination room of the two-room sterile processing facility, an instrument air outlet or portable compressed air is required.

[11]NFPA 99 permits the use of portable medical compressed air for single applications. Where cylinders are used for non-respiratory purposes, such as air for blowing down scopes and/or running decontamination equipment, NFPA 99 should be consulted for cylinder air quality, placement, and handling.

Proposed Language Based on the 2018 Outpatient *Guidelines*

Chapter 1.1 Introduction

***1.1-2 New Construction**

Projects with any of the following scopes of work shall be considered new construction and shall comply with the requirements in the *Guidelines for Design and Construction of Outpatient Facilities*:

> **A1.1-2 Resiliency in new construction.** Incorporation of design elements for resiliency should be considered for new construction projects where continuity of patient care services is required in the event of an emergency. Refer to Section 1.2-4.9 (Disaster, Emergency, and Vulnerability Assessment) for applicability.

1.1-3 Renovation

1.1-3.1 General

1.1-3.1.1 Compliance Requirements

***1.1-3.1.1.1** Where renovation or replacement work is done in an existing facility, all new work or additions or both shall comply with applicable sections of the *Guidelines* and local, state, and federal codes.

> **A1.1-3.1.1.1 Resiliency in renovation projects.** Incorporation of design elements for resiliency should be considered when renovating an existing facility where continuity of patient care services is required in the event of an emergency. Refer to Section 1.2-4.9

(Disaster, Emergency, and Vulnerability Assessment) for applicability.

Chapter 1.2 Planning, Design, Construction, and Commissioning

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1.2-2 Functional Program

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1.2-2.2 Functional Program Content

The functional program for a project shall include the following:

...

1.2-2.2.7 Operational Requirements

The operational requirements, which include but are not limited to the following, shall be described:

1.2-2.2.7.1 Projected operational use for project components

1.2-2.2.7.2 Relevant operational circulation patterns, including movement of staff, patients and their companions, members of the public, and materials and equipment

1.2-2.2.7.3 Departmental operational relationships and required adjacencies

1.2-2.2.7.4 Projected operational use and surge capacity of project components during emergency conditions

A1.2-2.2.7.4 Projections for operational use and surge capacity during emergency conditions are identified in

these facility-specific assessments: safety risk assessment (infection control risk assessment and disaster, emergency, and vulnerability assessment portions) and hazard vulnerability assessment.

***1.2-4 Safety Risk Assessment (SRA)**

A1.2-4 SRA. The safety risk assessment is a multidisciplinary, documented assessment process used to proactively identify hazards and risks and mitigate underlying conditions of the built environment that may contribute to adverse safety events. These adverse events include infections, falls, medication errors, security breaches, and musculoskeletal or other injuries. The SRA also includes assessment of the hazards and risks from natural and man-made emergency conditions.

The SRA process includes evaluation of the population at risk and the nature and scope of the project; it also takes into account the models of care, operational plans, sustainable design elements, and performance improvement initiatives of the health care organization. The SRA proposes built environment solutions to mitigate identified risks and hazards.

***1.2-4.1 General**

A1.2-4.1 More information and online tools to assist in the development of a safety risk assessment can be found on the websites of the Facility Guidelines Institute and the Center for Health Design. As well, information about the SRA and the disaster, emergency, and vulnerability assessment can be found in the FGI white paper *Guidance for Designing Health and Residential Care Facilities that Respond and Adapt to Emergency Conditions.*

1.2-4.1.1 SRA Requirement

1.2-4.1.1.1 All outpatient facility projects shall be designed and constructed to facilitate the safe delivery of care.

1.2-4.1.1.2 To support this goal, an interdisciplinary team shall develop a safety risk assessment.

1.2-4.1.2 SRA Components

See Table 1.2-1 (Safety Risk Assessment Components) to determine if the following SRA components are required for a project.

1.2-4.1.2.1 Infection control risk assessment (ICRA)

1.2-4.1.2.2 Patient handling and movement assessment (PHAMA)

1.2-4.1.2.3 Fall prevention assessment

1.2-4.1.2.4 Medication safety assessment

1.2-4.1.2.5 Behavioral and mental health risk assessment

1.2-4.1.2.6 Security risk assessment

1.2-4.1.2.7 Disaster, emergency, and vulnerability assessment (DEVA)

***1.2-4.1.3 SRA Responsibility and Scope**

1.2-4.1.3.1 The safety risk assessment shall be initiated and managed by the governing body during the planning phase of the project. ~~and~~

1.2-4.1.3.2 The safety risk assessment shall evolve with additional levels of detail as needed to support the creation of a safe environment throughout the design, construction, and commissioning phases of a project.

A1.2-4.1.3 SRA responsibility and scope for small facility projects. Risks such as infection prevention and security should be considered even for small projects, including tenant improvement projects. The safety risk assessment, which may be initiated by the governing body or the care provider, should identify the basic aspects of risk associated with the project early in the planning phase. These identified risk areas and related solutions will evolve over the course of project design, construction, and commissioning.

***1.2-4.1.5 SRA Process**

A1.2-4.1.5 SRA tools and methods. A range of high-priority activities to improve patient and caregiver safety outcomes should be considered during the predesign, design, and construction phases of a project.

***1.2-4.1.5.1 Identify hazards ~~and potential risks~~.** The governing body shall provide an assessment of the potential ~~harm to~~ hazards for patients, caregivers, and other users for the ~~risks~~ components listed in Table 1.2-1 (Safety Risk Assessment Components), identifying ~~the following: *(1) H~~ hazards specific to the project.

A1.2-4.1.5.1 ~~(1)~~ Hazards

a. Hazards include circumstances, processes, human activities, physical obstacles, and underlying conditions that may directly or indirectly contribute to harm to patients, staff, or other users or contribute to damage or loss. See appendix section A1.2-4.1.5.2 (Evaluation of underlying conditions that can cause adverse safety events) for more information.

b. Some hazards may be more anticipated than others (e.g., regionally associated weather events). Anticipated

hazards may come with some level of advance notice (e.g., minutes or hours for a tornado watch/warning or days for a potential hurricane landfall). Other hazards may be unanticipated (e.g., an explosion of stored chemicals, a terrorist attack). Some hazards may start as unanticipated and evolve into an anticipated event (e.g., a global pandemic).

~~(2) Historical data and/or national patient and caregiver safety trends relevant to the identified hazards~~

~~(3) Prioritization of the degree of potential harm to patients and/or caregivers from the identified hazards~~

***1.2-4.1.5.2 Evaluate ~~hazards and~~ risks from identified hazards.** The SRA team shall evaluate underlying conditions that contribute to an unsafe environment for the components listed in Table 1.2-1 (Safety Risk Assessment Components) and estimate associated risk considering the following: ~~:~~

(1) Likelihood (vulnerability), using historical data and/or national patient and caregiver safety trends relevant to the identified hazards

(2) Consequence (estimated degree of potential harm to patients and/or caregivers from identified hazards)

A1.2-4.1.5.2 Evaluation of underlying conditions that can cause adverse safety events

a. Underlying conditions include the physical environment, organizational and social factors, and task characteristics that can be affected by the design of a space, including the following:

—Noise

—Vibration

—Visual distraction and disorganization of space

—Light type, quality, and quantity for each location

—Surface characteristics for different spaces

—Indoor air characteristics for different spaces

—Sources of infection

—Ergonomics

—Staff fatigue

—Space required to accommodate functions

—Standardized locations for equipment (e.g., medical gas outlets, emergency call buttons)

—Opportunities for, and barriers or disincentives to, mobilization of patients

—Impediments to movement, maneuvering, and flow

—Communication systems

—Visibility of patients

—Automation (where possible)

—Support for family involvement in outpatient care

—Multi-use areas (e.g., a clinic located within a retail grocery store)

c. For additional information, see the Center for Health Design report "Designing for Patient Safety: Developing Methods to Integrate Patient Safety Concerns in the Design Process," which identifies 10 environmental factors as "latent conditions that can be designed to help eliminate harm." Such "built environment latent conditions [holes and weaknesses] that adversely impact patient safety" should be

identified and eliminated during the planning, design, and construction of outpatient facilities. The report can be found on the Center for Health Design website.

b. The multidisciplinary project team should carefully consider how outpatient facilities are sited, particularly as venues for outpatient care become more diverse and integrated with other functions. Retail settings provide additional opportunities and challenges that should be studied during the planning phases. For example, when designing a clinic within a larger retail environment, the project team should consider how access to the location might impact patients and other users. Venues with incongruent features (e.g., a site adjacent to a tobacco products display) should be avoided.

c. In the category of emergency preparedness, a hazard can include earthquakes, hurricanes, tornadoes, and other "natural" events. Hazards can also include terrorism, chemical spills, explosions, or other "man-made" events.

1.2-4.1.5.3 Generate solutions. The SRA team shall document proposed solutions that mitigate risks from the identified hazards.

***1.2-4.1.6 SRA Report**

After completing the SRA process, the governing body shall provide the following information and recommendations, which shall be incorporated into the planning and design documentation:

A1.2-4.1.6 SRA report.

a. Time and effort should be dedicated to patient and caregiver safety issues during the predesign phase (e.g., strategic planning, master planning, operational planning, and programming) of an outpatient facility

design project. The decisions made during predesign significantly affect the design parameters going forward and the safety outcomes of the project following occupancy. The safety risk assessment should be an important part of the continuous safety improvement program in any health care organization.

b. Requirements for submission of an SRA may vary by AHJ and the SRA may not be required until permitting, but this does not preclude the benefit of early planning and documentation to ensure inclusion of integrated solutions that mitigate risk in the built environment.

c. Health care organizations are required by CMS and others to conduct hazard vulnerability assessments (HVAs). Design solutions that support the safe delivery of care during disasters and emergencies should be coordinated with and supplement existing mandated HVAs. The intent of the disaster, emergency, and vulnerability assessment (DEVA) portion of the SRA report is to proactively identify built environment solutions (beyond critical infrastructure) that mitigate risk from potential hazards.

***1.2-4.2 Infection Control Risk Assessment (ICRA)...**

***1.2-4.3 Patient Handling and Movement Assessment (PHAMA)...**

***1.2-4.4 Fall Prevention Assessment...**

***1.2-4.5 Medication Safety Assessment...**

***1.2-4.6 Behavioral and Mental Health Risk (Psychiatric Patient Injury and Suicide Prevention) Assessment...**

***1.2-4.7 Security Risk Assessment…**

A1.2-4.7.2~~.1~~ Security elements of the safety risk assessment

a. *Security considerations for project design*….

b. *Emergency management security considerations.* Some outpatient facilities may provide both scheduled and emergency services, serve as part of local emergency response networks, and be expected to be functional, safe, and secure for patients, visitors, and staff while remaining prepared for natural and man-made emergencies 24 hours a day.

~~—~~The design of the facility should address the facility's role in responding to internal and external emergencies on its own or in coordination with local emergency response or public health authorities based on assessed risks. All other regulations for emergency operations should be considered when developing the design.

~~—An all-hazards approach to design should be applied to help the facility prepare for, respond to, and recover from man-made events and natural disasters.~~

***1.2-4.8 Disaster, Emergency, and Vulnerability Assessment (DEVA)**

A1.2-4.8 Disaster, emergency, and vulnerability assessment

a. The DEVA should include information developed as part of any facility-based hazard vulnerability assessment, but it should more specifically address the emergency preparedness program as it pertains to proactive design or renovation of the facility.

b. An all-hazards approach to design should be applied to help the health care organization prepare for, respond to, and recover from man-made events and natural disasters. [Moved from A1.2-4.7.2.1 in the security risk section (see above).]

***1.2-4.8.1 Disaster, Emergency, and Vulnerability Elements of the Safety Risk Assessment**

A1.2-4.8.1 A range of hazards and vulnerabilities should be considered in performing a facility-based disaster, emergency, and vulnerability assessment. The DEVA should include, but is not limited to, identification and review of the following:

a. Anticipated hazards (e.g., earthquake, hurricane)

b. Unanticipated hazards (e.g., explosion, infectious disease, hazardous material)

c. Patient population (e.g., acuity, ability levels)

d. Facility type

e. Potential surrounding community assets (assets in a rural area will differ from those in a large metropolitan area)

1.2-4.8.1.1 Anticipated hazards

*(1) The multidisciplinary SRA team shall review the organization's hazard vulnerability assessment (HVA) in conjunction with the development of the DEVA.

A1.2-4.8.1.1 (1) The hazard vulnerability assessment should be shared with the design team at the earliest stages of planning to confirm what has been established and which decisions should be reviewed with the design team.

(2) The DEVA shall identify anticipated hazards specific to a facility based on its geographic location.

1.2-4.8.1.2 Design features. Design features that provide resilience, hardening, flexibility, and adaptability during a disaster or emergency event shall be identified.

1.2-4.8.2 Disaster, Emergency, and Vulnerability Response

The design team shall incorporate identified disaster and emergency-related design features in the project design documents.

1.2-5.4 Physical Environment Elements

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***1.2-5.4.3 Wayfinding**

How clarity of access will be provided for the entire campus or facility using a wayfinding system. See Section 1.2-6.3 (Wayfinding) for more information.

A1.2-5.4.3 Wayfinding

a. Outpatient facility entry points should be clearly identified from all major exterior circulation modes (e.g., roadways, bus stops, vehicular parking).

b. Clearly visible and understandable signage, icons, universal symbols, visual landmarks (including views to the outside), and/or cues for orientation (including views to the outside) should be provided.

c. Boundaries between public and private areas should be well marked or implied and clearly distinguished.

d. A system of interior "landmarks" should be developed to aid occupants in cognitive understanding of

destinations. To be effective, landmarks should be unique and used only at decision points. Landmarks may include sealed water features, major art, distinctive color, or decorative treatments. These features should attempt to involve tactile, auditory, and language cues as well as visual recognition. When color is used as a wayfinding device, it should support the primary wayfinding system elements and be clearly distinguished from color palette decisions unrelated to wayfinding.

e. Signage systems should be flexible, expandable, adaptable, and easy to maintain. Signage should be consistent with other patient communications and supporting print, Web, and electronic media.

f. Health care organizations should consider how signage and wayfinding can be adapted during a disaster to provide meaningful real-time information for patients and staff. Consider a temporary signage plan that identifies the following:

—New uses and functions

—Zones of use, including but not limited to:

- Staff zones
- Public zones
- "Clean" vs. "contaminated" zones

***1.2-6.3 Wayfinding**

A1.2-6.3 Wayfinding

a. During the functional programming process, input from frontline staff, facility managers, visitors, families, and

patients should be sought regarding wayfinding. This should include evaluation of the most common and problematic scenarios to identify shortcomings and help develop design criteria to address them. Consideration should be given to the following:

—Needs of first-time users

—Stress experienced by patients and families while finding their way to unfamiliar areas in a facility

—Populations served (e.g., the elderly; children; and cognitively impaired, visually impaired, and other particularly vulnerable populations, including those with Alzheimer's and dementia)

—Needs of limited English proficient (LEP) individuals, speakers of other languages, and those with limited reading ability. Where possible, use the Universal Symbols in Health Care.

—Use of unique landmarks (e.g., design elements such as color, artwork, texture, change in architecture, exterior views, plants)

—Varied presentation of the same information to accommodate different cognitive processes (e.g., those used by different individuals or by the same individuals at different points during the wayfinding process)

—Integration of the wayfinding plan with relevant security plans

—If indicated by the safety risk assessment, wayfinding strategies that can be temporarily deployed during disaster/pandemic scenarios (e.g., storage for temporary signage or installation of digital signage)

1.2-6.5 Emergency Preparedness and Management

1.2-6.5.1 Planning and Design Considerations

During project planning and design, the following shall be considered:

***1.2-6.5.1.1** The likelihood a facility will experience events that go beyond the facility's normal operations

A1.2-6.5.1.1 Emergency preparedness assessments

The likelihood of a facility experiencing events that go beyond normal operations should be assessed and detailed in an annual hazard vulnerability assessment (HVA) ~~emergency preparedness assessment~~. These events could include natural disasters; utility failures; acts or threats of human violence; biological, nuclear or chemical exposures; surge capacity; evacuation; and mass casualties.

a. *Infrastructure assessment.* The ~~assessment~~ HVA should consider performance of structural and critical nonstructural building systems during an adverse event and the likelihood of loss of externally supplied power, gas, water, and communications from such a disaster.

b. *Facility planning.* Ideally, the ~~emergency preparedness assessment~~ HVA results will be used to ~~implement practices and plans~~ develop or revise an emergency operations plan (EOP) that will help the health care organization prevent, mitigate, and expediently recover from an event. Facility master planning should consider mitigation measures required to address conditions that may be hazardous to patients and conditions that may compromise the ability of the health care organization to fulfill its planned post-emergency medical response.

Resiliency requires a plan to absorb and recover from adverse events by preparing, preventing, protecting,

mitigating, and responding. The EOP ~~plan~~ should outline a health care facility's ability through mitigation and planning to:

—Handle patient influx due to a public health emergency or mass casualty event

—Coordinate and communicate effectively with community partners

—Adapt to changing conditions

—Recover from disruptions

—Resist probable deliberate attacks

—Improve technical and organizational capabilities

—Focus on reducing damage and disruptions to public health and safety

***1.2-6.5.1.2** Space needs in the event of an emergency for operations to:

A1.2-6.5.1.2 Space needs in an emergency. The location of the facility and the type of event in the community may require a health care facility to act as a shelter or support other health care system needs; if so, this must be considered in planning.

a. Space where patients, staff, and visitors can be safe in an emergency should be identified.

b. Provision of ~~space~~ storage for resources needed to respond in an emergency, such as medical supplies, materials, personal protective equipment, pharmaceuticals, communications equipment, transportation, food, water, utilities, and waste storage should be considered during project planning and design. Some of these resources could be accommodated

through mutual aid agreements between the health care organization and other local providers or vendors. Such storage capacity or plans should be sufficient for at least four continuous days of operation or longer if indicated by the facility's disaster, emergency, and vulnerability assessment (DEVA).

(1) ~~1.2-6.5.2.1~~ Protect facility occupants during the event

*(2) ~~1.2-6.5.2.2~~ Continue providing services as outlined in the health care organization's emergency operations plan (EOP).

A1.2-6.5.1.2 (2) ~~A1.2-6.5.2.2~~ **Design for continued building system operation.** For facilities that have been designated by a recognized federal, state, regional, or local mandate—or if determined by the DEVA for the facility—to remain operational in the aftermath of a disaster, special designs are ~~is~~ required to protect systems and essential building services such as power, water, medical gas systems, and, in certain areas, air conditioning. In addition, special consideration must be given to the likelihood of temporary loss of externally supplied power, gas, water, and communications.

Chapter 1.3 Site

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*1.3-1 General

A1.3-1 Flexible site considerations for emergency events. Provision of flexible open spaces that are strategically located on-site can support additional functional and programmatic needs that may be required during emergency events. To maximize functionality, design of a flexible site must factor in appropriate building systems and components, such as additional electrical

outlets and communication systems, to support potential added functions and programmatic requirements. In isolated, remote, or rural locations and urban locations with limited outside resources, support, or connectivity, the following should be considered:

a. Identification of on-site locations that can be used for disaster preparedness, response, and recovery. These areas may include paved parking and roads, open canopy and garage structures, gravel laydown areas, mobile unit pads, future expansion areas, and loading docks.

b. Provision of utility services to the identified locations for quick, convenient use when needed.

***1.3-2.3 Availability of Utilities**

Outpatient facilities shall have access to utilities (water, gas, sewer, electricity) to meet requirements in the facility chapters in this document.

A1.3-2.3 Outdoor utility connections for emergency use. Consideration should be given to providing, at minimum, capped utility connections (power, data, water, sewer) that are available from outside the building in areas designated for potential tent deployment in case of a disaster/pandemic.

1.3-3.1 Signage

Site signage shall be provided to direct people unfamiliar with the facility to parking areas and entrances.

A1.3-3.1 Temporary signage for emergency conditions. Plans should be considered for temporary signage

(including digital) to be installed during emergency conditions to facilitate new circulation and alternate arrival or pickup locations for vehicles and pedestrians.

***1.3-3.2 Lighting**

Site lighting shall be provided for the patient path of travel.

A1.3-3.2 Site lighting.

a. *Lighting controls.* Lighting controls should permit zoned operation, allowing facilities to provide multiple lighting levels or to designate night parking nearer the building. Lighting design for the site, roadway, and parking lots should control glare and minimize light pollution of the night sky or surrounding properties.

b. *Lighting for emergency conditions.* Mobile lighting solutions that can be deployed quickly should be planned for implementation during emergency conditions.

***1.3-3.3.2 Pedestrian Walkways**

Paved walkways shall be provided for pedestrian traffic.

A1.3-3.3.2 Pedestrian access during emergency conditions. Consideration should be given to how pedestrian access will be handled during a disaster/pandemic scenario. Supplementary pedestrian access routes may be activated or pedestrian access may be more limited. A second public entrance may be opened. Site design should be able to accommodate these possible changes.

1.3-3.4 Parking

***1.3-3.4.1 General**

A1.3-3.4.1 Parking

a. *Dedicated parking areas.* Dedicated patient and staff parking should be provided where possible. Additional parking considerations should be provided for emergency services patients.

b. *Alternate use of parking areas during emergency conditions.* During an emergency, parking areas may be used for alternate purposes, such as drive-through testing or a decontamination station. Parking areas should be designed to facilitate planned alternate uses.

1.3-3.4.1.1 Outpatient facilities shall provide parking capacity to meet the needs of patients, personnel, and the public.

1.3-3.4.1.2 Parking needs shall be evaluated for each new facility, major addition, or major change in function.

1.3-3.4.2 In the absence of local parking standards or ordinances, refer to individual chapters governing specific facility types for required parking capacity. In all instances, review individual chapters for requirements for dedicated emergency vehicle, patient transfer, and service parking.

***1.3-3.4.3** Unless otherwise prohibited by individual chapters, reduction of parking requirements shall be permitted; as acceptable to local authorities having jurisdiction.

A1.3-3.4.3 Parking requirements may be reduced in locations convenient to pedestrians, public transportation, or public parking facilities or where carpool, shuttle bus, or other alternative transportation arrangements have been developed.

Chapter 1.4 Equipment

1.4-1.2 Equipment List

An equipment list shall be developed and maintained throughout the design development process and included in the contract documents to assist in overall coordination of the acquisition, installation, and relocation of equipment.

*__1.4-1.2.1__ The equipment list shall include all items of equipment necessary to operate the facility during normal operations and during emergency conditions.

> **A1.4-1.2.1** When determining equipment needed for operations during emergency conditions, consider additional equipment procurement, storage, and deployment needs.

Chapter 2.1 Common Elements for Outpatient Facilities

*2.1-1 General

A2.1-1 ~~Common elements for outpatient facilities.~~ Outpatient facility functions

a. This chapter contains design elements that are common to most types of outpatient facilities. The outpatient facilities included in the *Guidelines for Design and Construction of Outpatient Facilities* are used primarily by patients who are able to travel or be transported to a facility for treatment, including those confined to wheelchairs. These facilities may be an outpatient unit

of a hospital, a freestanding facility, or an outpatient facility in a multiple-use building.

b. During a pandemic or other emergency event when patient services may be more limited, outpatient facilities may continue to provide post-acute, low-acuity medical/surgical, and observation-level care; dialysis, infusion, and other services that may serve those with chronic disease; and possibly critical care in an outpatient surgery center.

2.1-1.1 Application

2.1-1.1.1 Application of Part 1

All projects shall meet the standards in Part 1 of these *Guidelines* as amended in Section 2.1-1 (Common Elements for Outpatient Facilities—General).

2.1-1.1.2 Approaches to Application of Parts 2 and 3

Two approaches to applying the requirements in Parts 2 and 3 of the Outpatient *Guidelines* shall be permitted—Approach 1 and Approach 2....

2.1-1.1.2.2 Approach 2

*(1) If a project is for a facility type that is not listed in Section 2.1-1.1.2.1 (Approach 1) but will include elements in one or more of those facility chapters and/or elements in this common elements chapter (Chapter 2.1), those specific requirements shall be applied to the project.

A2.1-1.1.2.2 (1) Projects suited to Approach 2. Approach 2 is intended to be used for projects where the scope of services is not adequately described in only one of the outpatient facility chapters listed in Section 2.1-1.1.2.1. This approach identifies minimum requirements found in

the common elements chapter and in any facility chapters that are relevant to the project.

*(a) The requirements in the common elements chapter and in the facility chapters in Part 2 that support the services to be included in the project shall be identified during the planning phase.

*(b) The common element and specific facility chapter requirements identified as part of the project during the planning phase shall be documented in the basis of design.

A2.1-1.1.2.2 (1)(a) and (1)(b) Approach 2 process for identifying and documenting relevant requirements. Development of specialty outpatient facilities that are not included in the Outpatient *Guidelines* will depend on a detailed and specific functional program to establish physical environment requirements. Thus, Approach 2 is based on the performance assessment for the project space that underpins the functional program as well as practical application of relevant standards.

a. *Identification of services for Approach 2.* The project team using Approach 2 should identify the services to be included in the project, including both clinical and support services during normal operations and emergency conditions.

b. *Identification of sections of the* Guidelines *that apply to the project.*...

***2.1-1.4 Facility Layout**

Facility layout shall preclude unrelated traffic through patient care areas.

A2.1-1.4 Facility layout.

a. In general, public traffic should not go through patient care areas.

b. Consideration should be given to avoiding mixing patient populations from one clinical service with patient populations from another clinical service, although this is permissible when services are shared (e.g., imaging services).

c. *Emergency conditions considerations.* For outpatient facilities that may be open during an emergency condition, particularly a pandemic, the following should be considered in planning the facility:

—Means to control access that facilitates one-way flow for entry and exit and space for donning/doffing PPE

—Means to provide separate access points to different clinical services, with boundaries configured so each service can operate independently if necessary

—Means to convert a suite(s) into a negative pressure environment for treatment of infectious patients

For outpatient facilities that may be repurposed during emergency conditions, provision of a layout with increased visibility from patient care team work areas (e.g., racetrack design) should be considered.

***2.1-3.2.1 Examination Rooms**

Where an examination room is provided, it shall meet the requirements in this section.

A2.1-3.2.1 Offices and/or practitioner consultation rooms may be combined with examination rooms.

2.1-3.2.1.1 General

...

(2) Building system components

(a) See the following tables for exam room requirements:

(i) ~~(a)~~ Table 2.1-1 (Electrical Receptacles for Patient Care Areas in Outpatient Facilities)

(ii) ~~(b)~~ Table 2.1-2 (Station Outlets for Oxygen, Vacuum, Medical Air, and Instrument Air Systems in Outpatient Facilities)

(iii) ~~(c)~~ Table 2.1-3 (Locations for Nurse Call Devices in Outpatient Facilities)

(b) For exam rooms that are to be repurposed for 24/7 use during emergency conditions, additional infrastructure (e.g., electrical outlets for additional monitors and in-room charging, oxygen outlets and vacuum inlets) shall be provided.

(3) Telemedicine. All exam rooms shall meet the requirements in Section 2.1-3.4 (Accommodations for Telemedicine Services).

2.1-3.2.1.2 Single-patient examination/observation room

(1) General

(a) Where an examination room is used as an observation room, it shall be immediately accessible to the nurse or control station and a toilet room.

(b) A room arrangement in which an examination table, recliner, or chair is placed at an angle, closer to one wall than another, or against a wall to accommodate the type of patient being served shall be permitted.

*(2) Space requirements

A2.1-3.2.1.2 (2) Considerations for exam room use during an emergency condition. Exam rooms in clinics that may be repurposed for 24/7 care during an emergency should have a clear floor area of 110 square feet (10.22 square meters) to 120 square feet (11.15 square meters) to accommodate stretchers.

(a) Single-patient exam/observation room

(i) Area. Each single-patient examination/observation room shall have a minimum clear floor area of 80 square feet (7.43 square meters) as long as the clearances below can be met with the exam table or recliner that will be used.

(ii) Clearances. Room size shall accommodate a minimum clearance of 2 feet 8 inches (81.28 centimeters) at each side and at the foot of the examination table or recliner.

*(b) Single-patient exam room for specialty clinical services

(i) Area. Single-patient rooms for specialty clinical services that require larger examination rooms shall have a minimum clear floor area of 100 square feet (9.29 square meters).

A2.1-3.2.1.2 (2)(b) Specialty exam room. Rooms in specialty clinics such as rooms for eye or ear, nose, and throat (ENT) examinations, should be sized for the services provided, including necessary equipment.

*(ii) Clearances. Room size shall accommodate the following minimum clearances:

- 3 feet 6 inches (99.06 centimeters) at the side(s), head, or foot of the exam table or chair that correspond(s) with the care provider(s)' expected work position(s)

- 1 foot (30.48 centimeters) at all sides (side, head, or foot) of the exam table or chair other than the work position(s)

A2.1-3.2.1.2 (2)(b)(ii) Clearances at patient care positions in specialty exam rooms are not adequately or appropriately assured by centering the care position with clearances at sides and foot. The issue is adequate clearance at positions used by care providers, which may involve more than one provider and could include the head of the patient position. Where access to a patient position is unnecessary (e.g., at the head and on one side in eye exam lanes), smaller clearances are acceptable.

***2.1-3.2.1.3 Acuity-adaptable examination room.** Where an acuity-adaptable exam room is provided, it shall meet the requirements in Section 2.1-3.2.1.2 (Single-patient examination/observation room) as amended in this section:

A2.1-3.2.1.3 Acuity-adaptable exam room. These rooms are intended to accommodate high-acuity patients or to house two beds or three recliners when needed for surge capacity.

(1) General

(a) The number of acuity-adaptable exam rooms of each type to be provided in a facility shall be determined by the expected patient population and services to be provided.

(b) An exam room designed for an individual of size [see Section 2.1-2.7 (Single-Patient Examination/Observation Room)] shall be permitted to serve as an acuity-adaptable room if it meets the ventilation requirements in this section.

(2) Space requirements

(a) Area. Acuity-adaptable rooms shall be sized to accommodate two patients.

(b) Clearances. Room size shall permit a room arrangement with the following minimum clearances when the room is used as a single-patient examination room:

(i) 3 feet 6 inches (1.07 meters) on the provider side

(ii) 5 feet (1.52 meters) on the transfer side

(iii) 4 feet (1.23 meters) at the foot of the examination table

(iv) 18 inches (45.72 centimeters) at the head of the bed

(3) Ventilation. Acuity-adaptable exam rooms shall have switchable controls that allow conversion of the ventilation system from neutral pressure to either negative or positive pressure.

2.1-3.2.2 Procedure Room

2.1-3.2.2.1 General

(1) Application...

*(c) Where procedures that require a negative pressure environment are performed, a procedure room(s) with negative pressure shall be provided and identified with a sign. See Part 3 (ANSI/ASHRAE/ASHE 170: *Ventilation of Health Care Facilities*) for more information.

A2.1-3.2.2.1 (1)(c) Procedures that require different pressure relationships cannot be provided in the same procedure room. For example, procedure rooms where bronchoscopies will be performed require negative pressure; if these rooms are also used for other procedures, the other procedures must be able to be performed in a negative pressure environment. Signage identifying rooms with negative pressure can help

users choose appropriate rooms for procedures such as bronchoscopy or other aerosolized procedures.

2.1-3.3.2 Airborne Infection Isolation (AII) Room

***2.1-3.3.2.1 General**

A2.1-3.3.2.1 For additional information, refer to the Centers for Disease Control and Prevention (CDC) publication "Guidelines for Preventing the Transmission of *Mycobacterium tuberculosis* in Health-Care Settings" and "Guidelines for Environmental Infection Control in Health-Care Facilities," both available on the CDC website.

*(1) In facilities that serve patients with known infectious disease, the need for and number of airborne infection isolation rooms shall be determined by an infection control risk assessment (ICRA).

A2.1-3.3.2.1 (1) For facilities that will be used during emergency conditions for 24-hour/7-day care, the ICRA should consider this use in determining the number of AII rooms needed in the facility.

(2) Where an AII room(s) is provided, it shall meet the requirements for the clinical space (e.g., exam room, procedure room) and the requirements in this section.

2.1-3.3.2.2 AII room requirements

(1) Capacity. Each room shall accommodate only one patient.

(2) Hand-washing station. A hand-washing station shall be located in each AII room.

(3) Personal protective equipment (PPE) storage. Provision shall be made for PPE storage at the entrance to the room.

2.1-3.3.2.3 Anteroom~~.~~

(1) Whether an ~~An~~ anteroom is ~~not~~ required shall be determined by the infection control risk assessment (ICRA). See Section 1.2-4.2.2.1 (2) (ICRA Considerations—Design elements) for requirements. ~~; however, where~~

(2) Where an anteroom is provided, it shall meet the following requirements:

(a) ~~(1)~~ The anteroom shall provide space for persons to don PPE before entering the AII room and doff PPE before leaving.

(b) ~~(2)~~ All doors to the anteroom shall have self-closing devices.

(c) ~~(3)~~ The anteroom shall be equipped with at least the following:

(i) ~~(a)~~ Hand-washing station

(ii) ~~(b)~~ Storage for unused PPE

(iii) ~~(c)~~ Disposal/holding container for used PPE

2.1-3.4 Accommodations for Telemedicine Services

A2.1-3.4 Patient experience. Remote communications via electronic equipment, although not a replacement for in-person care, may be offered as a supplement where in-person care is not available or medically necessary. To assist in the adoption of telemedicine and maximize its benefits for elderly patients, those unaccustomed to electronic communication, and those with vision, hearing, or cognitive impairments, care should be given to remove technological barriers and provide telemedicine endpoints that facilitate natural communication for the widest range of participants. Facilities and systems used for telemedicine communications should strive to

maintain the level of safety, privacy, quality of care, and patient experience that would be expected for in-person communication.

2.1-3.4.1 General

Where clinical telemedicine services are provided in a health care facility, telemedicine spaces to accommodate those services shall meet the requirements in this section.

A2.1-3.4.1 Telemedicine service types

a. Services may include one-on-one interactions, consultations with a patient and family members (e.g., pediatric or elderly patients), examinations supported by a telemedicine presenter located with the patient, or specialty services such as dermatology or orthopedics. Each type of service may have specific needs for lighting and space to support the clinical function; for example, evaluation of patient gait requires unobstructed space to walk from one end of the bay, cubicle, or room to the other. Therefore, to achieve a functional design, it is important to know what services will be provided.

b. The requirements in this section are not intended to apply to virtual visits that do not require a physical examination of the patient or visits that originate from a physician's or patient's home.

***2.1-3.4.2 Telemedicine Bay, Cubicle, or Room**

A bay, cubicle, or room shall be provided for telemedicine services.

A2.1-3.4.2 Design considerations for telemedicine.
Any space that is HIPAA-compliant is suitable as a telemedicine health care provider environment. Following are recommendations for the telemedicine patient environment:

a. *Equipment*

—Camera placement should be set so recipients perceive the exchange as happening eye-to-eye. The discrepancy between gaze angle should be minimal.

—Temperature control should be considered based on the amount of electronic equipment that may generate significant amounts of heat.

—Depending on the complexity of equipment used, multiple outlets may be required for equipment. Outlets should be located near the unit to avoid wires/cables on the floor.

b. *Architectural details*

—Doors in view of the main camera should be able to be closed to assure maximum privacy during the telemedicine appointment.

—Placement of doors behind the patient should be avoided as this can make patients uncomfortable.

2.1-3.4.2.1 General

(1) A bay, cubicle, or room where clinical telemedicine services are provided shall meet the requirements of the section of the *Guidelines* that directly relates to the services provided and the patient population served.

(2) Where patient volume does not justify provision of a dedicated telemedicine room, the telemedicine room shall be permitted to serve other functions such as physician's office, exam room, or conference room.

(3) Locations where clinical telemedicine services are provided shall include capability for remote monitoring of vitals and pumps, etc., from staff stations.

2.1-3.7 Pre- and Post-Procedure Patient Care...

2.1-3.7.2 Patient Care Station Design

2.1-3.7.2.1 General

(1) Bays, cubicles, or single-patient rooms that meet the requirements in this section shall be permitted to serve as patient care stations.

(2) Pre- and post-procedure patient care stations shall be designed in pods that can be independently accessed and managed, including access to building system elements.

(3) Space shall be provided around the perimeter of the pre- and post-procedure patient care area that can be converted into an area for donning and doffing of personal protective equipment when needed.

2.1-3.7.2.2 Space requirements

(1) Area. When determining the area for a patient care station, space shall be provided to accommodate the equipment to be used.

*(2) Clearances

A2.1-3.7.2.2 (2) Clearances in patient care stations

a. Two bays may be used to accommodate non-standard equipment (e.g., an expanded-capacity patient bed), but clearances do not include any area that would have to be shared to meet the standard. Clearances noted around gurneys are between the normal use position of the gurney and any adjacent fixed surface or between adjacent gurneys.

b. Sizing all pre- and post-procedure patient care stations with the largest clearances is recommended to

provide flexibility for use during an emergency or for unanticipated future uses.

(a) Where bays are used, the following minimum clearances shall be provided:

(i) 5 feet (1.52 meters) between the sides of patient beds/ gurneys/lounge chairs

(ii) 3 feet (91.44 centimeters) between the sides of beds/ gurneys/lounge chairs and adjacent walls or partitions

(iii) 2 feet (60.96 centimeters) between the foot of beds/ gurneys/lounge chairs and the cubicle curtain

(b) Where cubicles are used, the following minimum clearances shall be provided:

(i) 3 feet (91.44 centimeters) between the sides and foot of beds/gurneys/lounge chairs and adjacent walls or partitions.

(ii) 2 feet (60.96 centimeters) between the foot of beds/ gurneys/lounge chairs and the cubicle curtain

(c) Where bays or cubicles face each other, an aisle with a minimum clearance of 8 feet (2.44 meters) independent of the foot clearance between patient stations or other fixed objects shall be provided.

(d) Where single-patient rooms are used, 3 feet (91.44 centimeters) shall be provided between the sides and foot of beds/gurneys/lounge chairs and adjacent walls or partitions.

2.1-3.7.2.3 ~~Reserved~~ Provisions for isolation of infectious patients

(1) An airborne infection isolation (AII) room is not required in pre- and post-procedure patient care areas.

(2) Where an ICRA determines provisions shall be made for the recovery of a potentially infectious patient with an airborne infection, the ICRA shall determine requirements for the following:

(a) Percentage of pre- and post-procedure patient care areas to be provided with controls to convert the area to negative pressure

(b) Percentage of patient care stations that are AII-ready single-patient rooms, including an anteroom, in pre- and post-procedure patient care areas

2.1-3.7.2.4 Patient privacy. Provisions shall be made for patient privacy in accordance with Section 2.1-3.1.2 (Patient Privacy).

2.1-3.7.2.5 Hand-washing station(s). See Section 2.1-3.8.7 (Hand-Washing Station) for requirements.

***2.1-3.7.2.6 Other design requirements**

A2.1-3.7.2.6 Equipment monitoring. Patient care station design should support use of equipment capable of remote monitoring of patient vitals, including blood oxygen saturation (SPO), and of pumps and other medical equipment. When the patient care station is a single-patient room, at minimum the equipment should be visible from outside the room through a window or view panel.

(1) For electrical receptacle requirements, see Table 2.1-1 (Electrical Receptacles for Patient Care Areas in Outpatient Facilities).

(2) For nurse call requirements, see Table 2.1-3 (Locations for Nurse Call Devices in Outpatient Facilities).

(3) For oxygen and vacuum requirements, see Table 2.1-2 (Station Outlets for Oxygen, Vacuum, Medical Air, and Instrument Air Systems in Outpatient Facilities).

*2.1-3.8.12 Soiled Workroom or Soiled Holding Room

A2.1-3.8.12 Soiled workroom or holding room

a. *Functions for soiled workroom and soiled holding room*

—*Soiled workroom. Soiled* items may be handled in a soiled workroom to prepare them for subsequent cleaning, disposal, or reuse (e.g., emptying and rinsing bedpans or emesis basins, emptying or solidifying suction canisters, rinsing and gross cleaning of medical instruments). As well, this room provides temporary storage for soiled items prior to their removal from the unit.

—*Soiled holding room.* This location is used for temporary storage of soiled materials and/or supplies prior to their removal from the facility.

b. *Emergency conditions considerations.* For outpatient facilities that expect to provide services during an emergency event, consideration should be given to providing a soiled workroom rather than a soiled holding room.

2.1-3.8.13 Equipment and Supply Storage

A2.1-3.8.13 Equipment and supply storage considerations for emergency events. An emergency event could disrupt the supply chain for items needed to support a surge event, including provision of patient care services. In isolated, remote, or rural locations and urban locations with limited outside resources, support, or connectivity, consider providing supplemental storage spaces—on-site or off-site if easily accessible—to accommodate specialized needs prior to, during, and after a disaster event. Additional storage may be needed for items such as medical

equipment (e.g., ventilators), medical gas cylinders, PPE, food, medical supplies, and generator diesel fuel.

***2.1-4.1.8.2 Specimen collection facilities**

A2.1-4.1.8.2 Alternate specimen collection sites. Planning for emergency conditions should include consideration of what is needed in the physical environment to support specimen collection sites located in the lobby and outside the facility, possibly in tents or parking structures.

(1) In facilities where urine or feces specimens are collected, a toilet room with hand-washing station and staff-controlled access shall be provided.

2.1-4.2.2 Pharmacy Areas

2.1-4.2.2.1 Security.** ~~ 2.1-4.2.1.2 (2)**~~ Access to the room or suite shall be controlled.

A2.1-4.2.2.1 Security ~~**A2.1-4.2.1.2 (2) Controlled access to the pharmacy.**~~

Architectural hardening to avoid break-ins is recommended. ~~Additional s~~Security information can be found in *Security Design Guidelines for Healthcare Facilities*, published by the International Association for Healthcare Security & Safety (IAHSS). ~~Architectural hardening to avoid break-ins is recommended.~~

Pharmacies should be considered vulnerable areas during emergencies, including times of civil unrest. Whether or not a pharmacy contains narcotics, intruders could be seeking medications. Security recommendations include providing bulletproof glass in pharmacy transaction windows and perimeter security features such as full-

height walls with anti-breach measures (e.g., plywood, security mesh). External windows should be given the same considerations.

2.1-4.2.8 Support Areas for the Pharmacy

...

***2.1-4.2.8.2 Office.** A separate room or area shall be provided for office functions.

A2.1-4.2.8.2 Office.

a. When sizing this room, consider the space needed to accommodate a desk, filing capabilities, communication equipment, and reference materials.

b. Consider providing additional data outlets and sound attenuation to support increased consultation regarding medications during an emergency condition.

2.1-4.2.8.3 Reserved

***2.1-4.2.8.4 Outpatient medication consultation area.** If medication is dispensed directly to patients from the pharmacy, an area for consultation and patient education shall be provided.

A2.1-4.2.8.4 Considerations for medication consultation during emergency conditions. Consider providing data outlets and sound attenuation to support increased consultation regarding medications that may become necessary during an emergency condition. Because consultation often requires face-to-face communication, configurations to support safe interaction with an infectious patient should be considered.

2.1-5.3 Environmental Services

2.1-5.3.1 Environmental Services Room

...

***2.1-5.3.1.2 Environmental services room(s) for facility-based environmental services.** Each environmental services room shall be provided with the following:

> **A2.1-5.3.1.2 Environmental services room features.** Environmental services rooms should be planned to accommodate carts where carts are used in the housekeeping process.

(1) Service sink or floor-mounted mop sink

*(2) Provisions for storage of supplies and housekeeping equipment

> **A2.1-5.3.1.2 (2) Supply and equipment storage**
>
> a. If further storage areas for housekeeping supplies and equipment are needed, storage locations outside the environmental services room may be used.
>
> b. In sizing storage for disinfection and cleaning supplies, consideration should be given to additional needs that may arise during an emergency condition, when the supply chain could be disrupted.

(3) Hand-washing station or hand sanitation dispenser

***2.1-6.2.1 Vehicular Drop-Off and Pedestrian Entrance**

> **A2.1-6.2.1 Drop-off and pedestrian entrance**
>
> a. *Roof overhang or canopy.* Climate, patient acuity, and community standards may influence whether a

covered or canopied entrance is desired. Where a roof overhang or canopy is provided, it should extend as far as practicable to the face of the driveway or curb of the passenger access door of the transport vehicle. Vehicles in the loading area should not block or restrict movement of other vehicles in the drive or parking areas immediately adjacent to the facility.

b. *Considerations for emergency conditions.* For outpatient facilities that expect to provide services during an emergency event, provision of the following should be considered:

—Power, data, and water connections at the drop-off and pedestrian entrance to facilitate conversion to external triage stations during an emergency event

—Means for an alternate point of access for potentially infectious patients

2.1-6.2.1.1 A minimum of one building entrance shall be reachable from grade level.

2.1-6.2.1.2 Building entrances used to reach outpatient services shall be clearly marked.

2.1-6.2.1.3 Building entrances used to reach outpatient services shall be located so patients need not go through other activity areas. (Shared lobbies shall be permitted in multi-occupancy buildings.)

***2.1-6.2.2 Reception**

A reception and information counter, desk, or kiosk shall be provided either at the main entry or at each clinical service.

A2.1-6.2.2 Considerations for emergency conditions. For outpatient facilities that expect to provide services

during an emergency event, provision of the following in or readily accessible to the reception area should be considered:

a. Sanitizing stations

b. Power/data points for deployment of temporary scanners and other equipment

c. Signage or other cues indicating changes in patient, staff, and visitor flow

d. Storage for screening equipment

***2.1-6.2.3 Waiting Area or Room**

A2.1-6.2.3 Waiting area or room

a. Consideration should be given to the special needs of specific patient groups in a shared/general waiting area. This may result in provision of separate accommodations for elderly patients or other patients such as those with PTSD, pediatric designated areas, or sick or well rooms.

b. Special attention should be paid to the path of travel to waiting areas or rooms for expanded-capacity wheelchairs. Further accommodations for persons of size are defined in Section 2.1-2 (Accommodations for Care of Patients of Size).

c. Provision of Wi-Fi access for public use, including infrastructure to support it, should be considered.

***2.1-6.2.3.1** The number and location of waiting area(s) or room(s) and associated seating needed to support the operational model of the health care organization shall be determined and designated in the project planning documents.

A2.1-6.2.3.1 Seating capacity for waiting areas or rooms.

a. See appendix table A2.1-a (Waiting Area Seating Capacity) for recommendations. New operational models may require less seating or fewer waiting spaces in non-typical locations.

b. During some emergency conditions, such as a pandemic, operational planning may shorten waiting times and employ physical distancing and a consequent reduction in available seating to lessen patient exposure to potential infection. For outpatient facilities that will continue providing services during an emergency event, these factors should be considered in making decisions about seating capacity in waiting areas or rooms.

***2.1-6.2.3.2** The waiting area shall be visible from a staff area, either by camera or direct staff sight line.

A2.1-6.2.3.2 Visual observation of waiting areas or rooms supports patient and staff safety.

2.1-6.2.3.3 Provisions for charging personal devices. Outlets for charging cell phones and mobile devices shall be made available.

***2.1-6.3 Administrative Areas**

A2.1-6.3 Multipurpose room. A multipurpose room(s) should be provided for private interviews, conferences, meetings, telemedicine, and health education purposes. Where health education is accommodated, the room(s) should be equipped for audiovisual aids.

Consideration should be given to designing multipurpose rooms for conversion to a staff respite space, space for donning and doffing personal protective equipment, a control center, or other use during an emergency as

determined by a disaster, emergency, and vulnerability assessment.

2.1-6.3.1 Reserved

***2.1-6.3.2 Interview Space**

(1) Where provided, space(s) for private interviews shall be separate from public areas.

(2) Shared use of an office or consultation room for this purpose shall be permitted.

A2.1-6.3.2 Interview space. Such spaces may be used for patient communication/interviews related to social services, credit, etc.

Consideration should be given to locating interview space at or close to a facility entrance to facilitate conversion during an emergency event to uses such as donning/doffing PPE and telemedicine communications.

***2.1-6.4 Support Areas for Staff**

A2.1-6.4 Staff shower. For outpatient facility spaces that will be repurposed for 24-hour care during an emergency event, consider providing a staff shower.

2.1-6.4.1 Staff Lounge

Where a staff lounge is provided, it shall include a hand-washing station.

2.1-6.4.2 Storage for Staff

Storage for staff personal effects (locking drawers, cabinets, or lockers) shall be readily accessible to individual work areas.

***2.1-7.2.2.3 Doors and door hardware…**

*(4) Door hardware~~. Lever hardware or push/pull latch hardware shall be provided.~~

(a) Where hands-on patient care will be provided, push/pull hardware shall be required.

(b) Lever hardware shall be permitted in all other locations.

A2.1-7.2.2.3 (4) Door protection should be provided where a door is subject to impact.

***2.1-7.2.2.8 Hand-washing stations…**

(5) Provisions for drying hands. Single-use or disposable provisions for hand drying shall be required at all hand-washing stations except hand scrub facilities.

(a) Hand-washing stations shall include a hand-drying device that does not require hands to contact the dispenser.

(b) These provisions shall be enclosed to protect against dust or soil.

~~(c) Hot air dryers shall be permitted.~~

(c) ~~(d) Where provided, s~~ Single-use towels shall be provided directly accessible to sinks but located to eliminate contact with splash from the sink.

***2.1-7.2.4.3 Privacy curtains.** Use of fabric privacy curtains shall be permitted if the fabric is washable.

A2.1-7.2.4.3 Privacy curtains. Use of disposable curtains or a wipeable fabric with a smooth surface is preferable.

***2.1-8.5.2 Telecommunications and Information Systems**

The requirements in this section shall be applied to outpatient facilities in freestanding buildings or a portion of a building with a separate occupancy classification.

A2.1-8.5.2 Telecommunications and information system considerations ~~requirements~~

a. Provision of these spaces should be considered for outpatient facilities located in a suite in a multi-tenant building (e.g., medical office buildings, outpatient surgery facilities, emergency facilities outside a hospital).

b. *Considerations for disaster events*

—Consideration should be given to location, access, availability, and placement of telecommunication and broadband access points (hard-wired and WiFi) to support flexibility prior to, during, and after a disaster event. Strategically locating telecommunication and broadband access points can support additional functional and programmatic requirements during an emergency event.

— Surge locations identified during planning should have access to telecommunication and broadband access points so they can properly function as an extension of the facility and connect to outside support services.

—See appendix section A1.3-1 (Flexible site considerations for emergency events) for site planning considerations.

Chapter 2.5 Specific Requirements for Urgent Care Centers

2.5-3.2.1 Urgent Care Examination Room

Urgent care exam rooms shall meet the requirements in Section 2.1-3.2.1 (Examination Rooms) as amended in this section.

2.5-3.2.1.1 Reserved

2.5-3.2.1.2 Space requirements

*(1) Where bays are used, the following minimum clearances shall be provided:

> **A2.5-3.2.1.2 (1)** For an urgent care center that will provide services during an emergency event, provision of space to allow conversion to 6 feet (1.83 meters) between sides of lounge chairs/stretchers should be considered.

(a) 4 feet (1.22 meters) between the sides of lounge chairs/stretchers

(b) 2 feet 8 inches (81.28 centimeters) between the sides of gurneys/lounge chairs and adjacent walls or partitions

(c) 2 feet 8 inches (81.28 centimeters) between the foot of gurneys/lounge chairs and the cubicle curtain

(2) Where cubicles are used, a minimum clearance of 2 feet 8 inches (81.28 centimeters) shall be provided between the sides and foot of gurneys/lounge chairs and adjacent walls, partitions, or cubicle curtains.

(3) Where single-patient exam rooms are used, they shall comply with the requirements in Section 2.1-3.2.1.2 (Single-patient examination/observation room).

Chapter 2.6 Specific Requirements for Infusion Centers

2.6-3 Patient Care and Diagnostic Areas

*2.6-3.1 Infusion Area

An infusion area shall be provided.

*2.6-3.1.1 General

A2.6-3.1.1 Infusion area design considerations

a. The size of the infusion area, and the ratio of open patient care stations and private bays/cubicles/rooms, should depend on the patient acuity mix and planned use of the facility. Bays and cubicles should be considered private. Provision of at least one private treatment room is recommended.

b. *Emergency condition considerations.* For infusion centers that will provide services during an emergency condition, particularly a pandemic or epidemic, consider the following to facilitate services for infectious patients:

—Sizing the infusion area to allow for 6 feet (1.83 meters) between patient care stations and between patient care stations and staff work areas

—Providing at least one airborne infection isolation room with adjoining toilet

2.8-3.4.3 Multiple-Patient Treatment Room

2.8-3.4.3.1 General

(1) Space and provisions for several patients shall be permitted in a multiple-patient treatment room that meets the requirements in this section.

(2) Combining bays to accommodate patients of size shall be permitted. See Section 2.8-3.4.6 (Treatment Room for Patients of Size) for more information.

2.8-3.4.3.2 Space requirements

(1) Area. Multiple-patient treatment rooms shall have separate patient bays or cubicles with a minimum clear floor area of 80 square feet (7.43 square meters) per patient care station.

(2) Clearances. The following minimum clearances shall be provided:

*(a) 5 feet (1.52 meters) between the sides of adjacent patient beds

A2.8-3.4.3.2 (2)(a) For an urgent care center that will provide services during an emergency event, provision of space to allow conversion to 6 feet (1.83 meters) between sides of adjacent patient beds should be considered.

(b) 4 feet (1.22 meters) between the sides of patient beds and adjacent walls or partitions

Chapter 2.10 Specific Requirements for Renal Dialysis Centers

2.10-3.2.2 Hemodialysis Patient Care Stations

2.10-3.2.2.1 Space requirements

(1) Area. Individual hemodialysis patient care stations shall have a minimum clear floor area of:

(a) 80 square feet (7.44 square meters) where dialysis chairs are used

(b) 90 square feet (8.36 square meters) where gurneys are used

*(2) Clearances. The following minimum clearances shall be provided:

A2.10-3.2.2.1 (2) The requirement for a minimum of 4 feet (1.22 meters) between gurneys/dialysis chairs is due to the potential splash risk related to dialysis procedures and clearances needed for safe patient care. Requirements for provision of additional space may be a consideration for the ICRA.

*(a) 4 feet (1.22 meters) between the sides of gurneys/dialysis chairs

A2.10-3.2.2.1 (2)(a) For a renal dialysis center that will provide services during an emergency event, provision of space to allow conversion to 6 feet (1.83 meters) between sides of adjacent gurneys/dialysis chairs should be considered.

(b) 3 feet (1.22 meters) between the sides of gurneys/dialysis chairs and adjacent walls or partitions

(c) 2 feet (60.96 centimeters) between the foot of a gurney/ dialysis chair and a cubicle curtain

Proposed Language Based on the 2018 Residential *Guidelines*

Chapter 1.2 Planning/Predesign Process

1.2-2.2 Functional Program Content

…

1.2-2.2.2 Functional Requirements…

1.2-2.2.2.2 Explanation of the functional requirements for the project shall cover, at minimum, the following:

…

(2) Operational circulation patterns. These shall include interior and exterior circulation patterns for:

*(a) Residents, staff, and family/visitors

A1.2-2.2.2.2 (2)(a) Circulation pattern considerations. Infectious disease events may require residential care facilities to alter building circulation patterns. Residential care organizations should identify in the emergency operations plan:

a. Provisions for resident food deliveries in the event of altered circulation patterns

b. How staff work areas can be adapted to minimize unrelated travel through other areas of the facility

(b) Equipment for infectious waste handling

…

(4) Short- and long-term planning considerations. These shall include the following:

(a) Flexibility and future growth

(b) Impact on existing adjacent facilities

(c) Effect on existing operations

(d) Integration of technology and equipment

(e) Changes in resident population over time, including cognitive and physical abilities

(f) Provisions for end-of-life care for residents and support of families

(g) Potential impacts of decentralizing food service to serve smaller groupings of residents during emergency conditions

*(h) Methods of communication

A1.2-2.2.2.2 (4)(h) Communication during emergencies. Communication becomes especially important during emergencies. For this reason, a communications plan should be included in the organization's emergency operations plans. A variety of approaches should be employed, ranging from low-tech solutions (e.g., white boards or bulletin boards) to technology-based communications (e.g., direct messaging, apps, portals, message boards, televisions).

1.2-3.1.1 RSRA Requirement

***1.2-3.1.1.1** Every new or renovated residential health, care, or support facility shall be designed to facilitate safe delivery of care consistent with the level of care outlined in the functional program.

1.2-3.1.1.2 To support this goal, ~~a resident safety risk assessment shall be developed and completed by an interdisciplinary team~~ a multidisciplinary team shall review the organization's hazard vulnerability assessment (HVA) in conjunction with development of a resident safety risk assessment (RSRA).

***1.2-3.1.2 RSRA Components**

The RSRA shall address how the physical environment of the residential health, care or support facility may affect resident safety outcomes and shall include assessment of the components identified in Table 1.2-1 (Resident Safety Risk Assessment Components).

> **A1.2-3.1.2 RSRA components.** The resident safety risk assessment should also address how the physical environment of the residential health, care or support facility can help maintain residents' functional capabilities.
>
> For additional information on safety outcome categories incorporated in the RSRA component descriptions, see a literature review undertaken by the Center for Health Design (CHD): "Summary of Literature Review: Resident Safety Risk Assessment"(July 2012) on the CHD website (www.healthdesign.org). See the Facility Guidelines Institute website (www.fgiguidelines.org) for a RSRA matrix based on six categories of resident outcomes identified in the CHD literature review.

1.2-3.1.3 RSRA ~~Timing~~ Responsibility and Scope

1.2-3.1.3.1 The resident safety risk assessment shall be initiated by the care provider during the functional programming phase of the health, care, or support facility project (i.e., before construction begins) and continue through project construction and commissioning as applicable.

1.2-3.1.4 RSRA Team

1.2-3.1.4.1 The care provider shall appoint ~~an interdisciplinary~~ a multidisciplinary team to conduct the resident safety risk assessment.

***1.2-3.1.4.2** The RSRA team shall include stakeholders for the identified project

> **A1.2-3.1.4.2 RSRA team members.** Project stakeholders may include the following as well as others, depending on the nature and needs of the project:
>
> a. Maintenance and environmental services staff
>
> b. Safety, security and transportation staff
>
> c. Direct care staff
>
> d. Quality assurance staff
>
> e. Activity staff
>
> f. Management staff
>
> g. Therapy staff
>
> h. Planning and design professionals
>
> i. Residents and family members
>
> j. Emergency preparedness officers
>
> k. Risk management professionals
>
> l. Insurance provider

1.2-3.1.4.3 Members of the team shall be convened as a group as needed to maintain continuity and integration of the RSRA components.

1.2-3.1.4.4 Individual members shall be engaged to develop additional detail according to their areas of expertise.

***1.2-3.1.5 RSRA Process**

The care provider shall ~~complete a resident safety risk assessment to determine potential risks and resulting impacts to residents and caregivers for each space and building component that is part of the project.~~ provide an assessment of the potential hazards to residents, caregivers, and other users for the components listed in Table 1.2-1 (Resident Safety Risk Assessment Components). This shall include identification of hazards specific to the project.

> **A1.2-3.1.5 Hazards.** Hazards include circumstances, processes, human activities, physical obstacles, and underlying conditions that may directly or indirectly contribute to harm of patients, staff, or other users or contribute to damage to or loss of property.
>
> Some hazards may be more anticipated than others (e.g., those with a regionally based likelihood). Anticipated hazards may come with some level of advance notice, minutes or hours for a tornado or days for a hurricane. Other hazards may be unanticipated (e.g., an explosion of stored chemicals or a terrorist attack). Some hazards may start as an unanticipated event and evolve into an anticipated one (e.g., a global pandemic).

1.2-3.1.5.1 Evaluate risks from identified hazards. ~~Identify risks. For each space in the building, the RSRA shall identify the following specific categories of risk:~~ The RSRA team shall evaluate underlying conditions that contribute to an unsafe environment for each component listed in Table 1.2-1 (Resident Safety Risk Assessment Components) and estimate associated risks based on the following:

(1) ~~Infection control risk~~ Likelihood (vulnerability), using historical data and/or national patient and caregiver safety trends relevant to the identified hazards

(2) ~~Resident mobility and transfer risk~~ Consequence, the estimated degree of potential harm to patients and/or caregivers from the identified hazards

~~(3) Resident fall risk and prevention~~

~~(4) Resident dementia and mental health risk~~

~~(5) Medication error risk~~

~~(6) Security risk~~

~~(7) Disaster risk and emergency preparedness~~

~~*~~**1.2-3.1.5.2 Evaluate ~~risks and~~ opportunities to enhance quality of life.** ~~(3)~~Identified quality-of-life opportunities shall be evaluated for the following:

~~(1) The care population profile (including cognitive abilities of residents) identified during the functional programming process shall be used as a basis for evaluating resident safety-related risks and quality-of-life opportunities.~~

~~(2) Identified risks should also be evaluated for the following:~~

~~(a) Likelihood of occurrence based on historical data, if available~~

~~(b) Degree of potential harm to residents~~

(1) ~~(a)~~ Likelihood of opportunity based on historical data, if available

(2) ~~(b)~~ Degree of potential enhancement to resident quality of life

~~**A1.2-3.1.5.2 Evaluation of risks and opportunities to enhance quality of life**~~

~~a. Each space should be assessed for the presence of~~

~~harmful, stress-inducing agents or latent conditions as well as for opportunities to mitigate those conditions to enhance quality of life. Examples include the following:~~

- ~~Noise and vibration~~
- ~~Visual distraction~~
- ~~Light type, quality, and quantity, including lighting that addresses specific tasks and promotes ease of ambulation~~
- ~~Surface characteristics, including environmental sources of infection~~
- ~~Indoor air characteristics, including environmental sources of infection~~
- ~~Ergonomics, including design features that contribute to staff fatigue~~
- ~~Space requirements, including space adjacencies that do not support the care model~~
- ~~Visual disorganization of space, including lack of standardization in layout and location of spaces and equipment~~
- ~~Impediments to resident movement and ambulation, including environmental hazards that may cause residents to slip, trip, or fall~~
- ~~Impediments to staff movement and workflow, including environmental hazards that may cause staff to slip, trip, or fall~~
- ~~Communication, including design features that may hinder communication between staff members, residents and staff, residents and family members, and staff and family members.~~

~~—Space requirements that may unduly limit auditory, visual, and/or lighting control by residents and family~~

~~*~~**1.2-3.1.5.3 ~~Prepare RSRA reporting and comply with the recommendations provided~~ Generate solutions.** Proposed solutions that mitigate risk from the identified hazards shall be documented.

***1.2-3.1.6 RSRA report.** After completing the RSRA process, the care provider shall provide a report detailing the information and recommendations developed by the RSRA team, which shall be incorporated into the project planning and design documentation. The report shall include:

A1.2-3.1.6 RSRA report

a. Time and effort should be dedicated to resident and caregiver safety issues during the predesign phase (e.g., strategic planning, master planning, operational planning, programming) of a residential health, care and support facility project. Decisions made during predesign significantly affect design parameters going forward and the safety outcomes of the project following occupancy. The RSRA should be an important part of the continuous safety improvement program in any care organization.

b. Requirements for submission may vary by AHJ and the RSRA may not be required until permitting, but this does not preclude the benefit of early planning and documentation to ensure integrated solutions that mitigate risk in the built environment.

c. Organizations are required to conduct hazard vulnerability assessments (HVAs). Design solutions that support the safe delivery of care during emergency

conditions should be coordinated with and supplement existing mandated HVAs. The intent of the disaster, emergency, and vulnerability assessment (DEVA) portion of the RSRA is to proactively understand the role of the built environment (beyond critical infrastructure) in solutions that mitigate risk from potential hazards.

~~***1.2-3.1.5.3 Prepare RSRA reporting and comply with the recommendations provided.**~~

~~**A1.2-3.1.5.3** Where available, benchmarked resident and caregiver safety data and national industry resident and caregiver safety trends should be used as a benchmark for developing the report.~~

~~(1) The RSRA team shall produce a written report that:~~

~~(a) Identifies known environmental risks based on RSRA components to be used in development of the functional program and in the design, construction, and commissioning of a residential health, care or support facility:~~

~~(i) Infection control risk~~

~~(ii) Resident mobility and transfer risk~~

~~(iii) Resident fall risk and prevention~~

~~(iv) Resident dementia and mental health risk~~

~~(v) Medication error risk~~

~~(vi) Security risk~~

~~(vii) Disaster risk and emergency preparedness~~

~~(b) Specifies design features intended to reduce or eliminate potential risks from adverse events for inclusion in the project design~~

~~(2) The conclusions in the written report shall:~~

~~(a) Be incorporated into the functional and physical space programs.~~

~~(b) Remain an active component of the following project documents:~~

~~(i) Planning, design, equipment and furniture specifications~~

~~(ii) Construction documentation~~

~~(iii) Commissioning records~~

~~(iv) Postoccupancy evaluation documents~~

~~(3) Changes to the original design plans and as-built documentation, including changes in identified risks and solutions, shall be recorded, updated, and shared among RSRA team members throughout project design, construction, and commissioning.~~ [Relocated to Section 1.2-3.1.7.2 (2).]

1.2-3.1.6.1 Resident and caregiver safety risks identified by the RSRA

1.2-3.1.6.2 Opportunities to improve the quality of life for residents that can be addressed in the project design

1.2-3.1.6.3 Design features to be incorporated in the project to mitigate hazards and risks

1.2-3.1.6.4 Design strategies being implemented to reduce, mitigate, or eliminate identified hazards and risk and improve quality of life

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1.2-3.1.7 RSRA Compliance

1.2-3.1.7.1 RSRA documentation

(1) Written records shall remain an active part of the project

documents for the duration of design, construction, and commissioning.

(2) The records shall include the RSRA recommendations report and any documentation completed as part of the RSRA process.

1.2-3.1.7.2 RSRA communication

(1) The RSRA team shall provide updates to the planners and designers for compliance with additional levels of detail generated during the project for all safety components listed in Table 1.2-1 (Resident Safety Risk Assessment Components).

(2) ~~1.2-3.1.5.3 (3)~~ Changes to the original design plans and as-built documentation, including to changes in identified risks and solutions, shall be ~~recorded~~ documented, updated, and continually shared ~~among~~ between the RSRA team ~~members~~ and the designers, planners, governing body, and contractor. ~~throughout project design, construction, and commissioning.~~

***1.2-3.8 Disaster, ~~Risk and~~ Emergency, ~~Preparedness~~ and Vulnerability Assessment**

A1.2-3.8 Disaster, ~~risk and~~ emergency ~~preparedness~~, and vulnerability assessment (DEVA). Residential health, care, and support facilities generally are expected to be functional, safe, and secure for residents, family members, visitors, and staff while remaining prepared for natural and man-made emergencies 24 hours a day/7 days a week.

a. ~~An evaluation of potential risks from disasters informs the emergency preparedness plan.~~ The DEVA should include information developed as part of any facility-based hazard vulnerability assessment, but it should more specifically address the emergency preparedness program as it pertains to proactive design or renovation of the facility.

b. ~~Design of the facility should consider e~~Emergency management practices that allow for the flexibility and resilience required to manage emergency events shall be considered in the design of the facility.

c. ~~A potential risks~~ An all-hazards approach to ~~the~~ design should be applied to help the care provider prepare for, respond to, and recover from man-made events and natural disasters.

***1.2-3.8.1 Disaster, Emergency, and Vulnerability Elements of the Resident Safety Risk Assessment**

A1.2-3.8.1 A range of hazards and vulnerabilities should be considered in performing a facility-based disaster, emergency, and vulnerability assessment. The DEVA should include, but is not limited to, identification and review of:

a. Anticipated hazards (e.g., earthquake, hurricane, nuclear facility accident)

b. Unanticipated hazards (e.g., explosion, infectious disease, hazardous material)

c. Resident/participant/client population (e.g., acuity, ability levels)

d. Facility type

e. Potential surrounding community assets (assets in a rural area will differ from those in a large metropolitan area)

1.2-3.8.1.1 Anticipated hazards. The ~~RSRA report~~ DEVA shall identify anticipated hazards specific to a facility based on its geographic location.

***1.2-3.8.1.2 ~~Provisions for disaster preparedness~~ Design features.** Design features that provide resilience, hardening, flexibility, and adaptability during a disaster or emergency event shall be identified.

A1.2-3.8.1.2 Design features ~~Provisions for disaster preparedness~~

a. *Design for continued operation...*

b. *Wind- and earthquake-resistant design for new buildings...*

c. *Design to mitigate the potential for progressive collapse...*

d. *Flood protection*

e. *Emergency supply storage*

—Required supplies. Should normal operations be disrupted, the facility should have adequate storage capacity for, or a functional program contingency plan to obtain food, sterile supplies, medication supplies, linen, and water for sanitation.

—Storage capacity. Such storage capacity or plans should be sufficient for at least four continuous days of operation.

f. Design to address a pandemic

—Facilities should be designed to support design recommendations from the Centers for Disease Control and Prevention to limit the spread of infection.

—During a pandemic, staff should have dedicated space, accommodations, and supports to facilitate overnight stays in the facility.

~~*~~1.2-3.8.2 ~~Compliance Elements~~ Disaster, Emergency, and Vulnerability Response

~~**1.2-3.8.2.1** In locations with recognized potential for hurricanes, tornadoes, flooding, earthquakes, or other regional disasters, the need to protect the life safety of all residential health, care, and support facility occupants and the potential need for continuing~~

~~services following such a disaster shall be considered during project planning and design.~~

~~**1.2-3.8.2.2 Disaster preparedness plan**~~

~~(1) A disaster preparedness plan for the new construction or renovation project shall be included in the RSRA report.~~

~~(2) This plan shall include disaster planning risk mitigation recommendations prepared by the multidisciplinary team that address the following:~~

1.2-3.8.2.1 Documentation. The design team shall incorporate identified disaster- and emergency-related design features into the project design documents.

1.2-3.8.2.2. In addition to emergency-related design features, the disaster, emergency and vulnerability response shall include disaster planning risk mitigation recommendations that address the following:

(1) ~~(a)~~ Resident placement and relocation

(2) ~~(b)~~ Standards for barriers and other protective measures required to protect areas of refuge from identified potential disasters

(3) ~~(c)~~ Additional requirements in ~~See~~ Section 1.2-3.2 (Infection Control Risk Assessment) ~~for additional information and requirements.~~

~~**A1.2-3.8.2 Disaster preparedness compliance**~~

~~a. Facility evaluation. Care providers of existing facilities should evaluate their facility's ability to withstand the effects of regional natural disasters. The assessment should consider performance of structural and critical nonstructural building systems and the likelihood of loss of externally supplied power, gas, water, and communications under such conditions.~~

~~b. Facility planning. Facility master planning should consider mitigation measures required to address conditions that may be hazardous to residents and conditions that may compromise the ability of the facility to fulfill care needs.~~

~~c. Seismic considerations. Particular attention should be paid to seismic considerations in areas where the seismic design classification of a building would fall into Seismic Design Category C, D, E, or F as described in ASCE/SEI 7: "Minimum Design Loads for Buildings and Other Structures."~~

1.2-4.5.3 Signage and Wayfinding

A1.2-4.5.3 Signage and wayfinding

…

d. Descriptive signage should be posted on the interior and exterior sides of entry doors with any special instructions for entry and exit during emergency conditions. Instructions should be provided in all languages commonly found in the resident, staff, and community population.

e. Care provider organizations should consider how signage and wayfinding can be adapted during a disaster to provide meaningful real-time information for residents and staff. Consider a temporary signage plan that identifies the following:

—New uses and functions

—Zones of use, including but not limited to:

- Staff zones

- Public zones
- "Clean" vs. "dirty" zones

Chapter 1.3 Site Selection

***1.3-1 General**

A1.3-1 Flexible site considerations for emergency events. Provision of flexible open spaces that are strategically located on-site can support additional functional and programmatic needs that may be required during emergency events. To maximize functionality, design of a flexible site must factor in appropriate building systems and components, such as additional electrical outlets and communication systems, to support potential added functions and programmatic requirements. In isolated, remote, or rural locations and urban locations with limited outside resources, support, and connectivity, the following should be considered:

a. Identification of on-site locations that can be used for disaster preparedness, response, and recovery. These areas may include paved parking and roads, open canopy and garage structures, gravel laydown areas, mobile unit pads, future expansion areas, and loading docks.

b. Provision of utility services to the identified locations for quick, convenient use when needed

Chapter 2.1 Site Elements

***2.1-2.4 Access to Utilities**

A2.1-2.4 Availability of utilities in an emergency. The need for emergency and backup water supplies, ~~emergency~~ backup generators, and limited-capacity essential electoral system ~~backup emergency~~ power should be evaluated and addressed in the functional program. The need for additional generator capacity to supply power to HVAC systems and equipment, meal preparation and storage equipment, access control systems, and other systems and equipment needed in an emergency should be evaluated as part of the facility's hazard vulnerability assessment with an eye toward possible extended use beyond minimums mandated by other codes during emergency conditions.

2.1-3.6. Landscape Features

***2.1-3.6.1 General**

See Section 1.2-4.5.1 (Light) and Section 1.2-4.5.2 (Views of and Access to Nature) for additional requirements.

***2.1-3.6.2 Outdoor Activity Spaces**

Gardens and outdoor activity spaces shall be located to receive direct sunlight at some time during the day.

A2.1-3.6.2 Outdoor activity spaces. Facilities should provide outdoor spaces designed to promote outdoor activity on the part of residents, participants, and outpatients. Views of outdoor spaces from common dining, living, and activity rooms and from therapy areas can encourage users to go outdoors. Facilitating independent access to outdoor space, such as locating doors to outside space near resident rooms and providing automatic opening doors and flush thresholds will encourage residents to go outside without assistance. In new construction, provision of direct outdoor access from

each resident living area in each household or unit should be considered.

…

c. *Outdoor areas for visitation.* Provision of an outdoor area easily accessible to the central interior common spaces of the building should be considered for the intended purpose of visitation during times of pandemic. The layout of this space should provide opportunities for family and friends to visit, allowing for proper physical distancing measures and providing heating or shading to improve comfort.

Chapter 2.3 Design Elements

2.3-2.3.2 Lobby

2.3-2.3.2.1 General

(1) See the facility chapters in Parts 3 through 5 for additional requirements.

*(2) Shared lobbies shall be permitted in multi-occupancy buildings.

A2.3-2.3.2.1 (2) Where possible, staff should have a dedicated building entrance and exit that is physically separate from entrances for residents, visitors, and service providers. During infectious disease events, space at the building entry should be provided for health screening per CDC recommendations. Design considerations should include the location and number of entrances and how access and circulation may need to be identified during emergency events.

2.3-4.2.2 Medication Distribution and Storage Locations (Centralized and Decentralized)

2.3-4.2.2.1 General

(1) Provisions shall be made to support 24-hour distribution of medications.

*(2) A medication room, a self-contained medication distribution unit, medication storage in resident rooms, or other approaches acceptable to the authority having jurisdiction (AHJ) shall be permitted to be used for preparing, dispensing, and administering medications.

> **A2.3-4.2.2.1 (2)** Provision of secured medication storage in each resident room is shown to reduce medication errors. In-room refrigerators to store refrigerated medications should be considered on a resident-by-resident basis.

***2.3-4.2.4.1 Storage for equipment and supplies for care and services.** Storage space(s) for equipment and supplies used by staff for resident, participant, and outpatient care and services shall be immediately accessible to the areas when they are used.

> **A2.3-4.2.4.1 Equipment and supply storage**
>
> a. *Equipment and supply storage items*
>
> —Equipment may include portable lifts, movable commodes, shower chairs, and carts
>
> —Supplies may include linens, disposable products, slings, accessories for lifts such as battery chargers, dressings, office supplies, etc.

b. *Equipment and supply storage considerations for emergency events.* An emergency event could disrupt the supply chain for items that are necessary to support a surge event, including provision of resident care services. In isolated, remote, or rural locations and urban locations with limited outside resources, support, or connectivity, provision of supplemental storage spaces—on-site or off-site if easily accessible—should be considered to accommodate specialized needs prior to, during, and after a disaster event. Additional storage may be needed for items such as medical equipment (e.g., ventilators), medical gas cylinders, PPE, food, medical supplies, and generator diesel fuel.

(1) Sufficient storage space(s) shall be provided to keep required corridor width free of equipment and supplies.

(2) Cabinets, closets, rooms, and alcoves shall be permitted to provide storage.

***2.3-4.2.10 Accommodations for Tele-Visits**

A2.3-4.2.10 Tele-visit considerations. Organizations should encourage and facilitate alternate methods of communication with residents via videoconferencing technology. During emergency conditions, which may limit physical interaction with family, tele-visit capability becomes important. Wireless technology and tablets can be used to provide this function to families via a variety of videoconferencing apps and platforms.

***2.3-4.3.2 Staff Lounge Area**

A2.3-4.3.2 Staff lounge area. Provision of the following should be considered:

a. Access to views and outdoor space from the staff lounge area. See Section 1.2-4.5.2 (Views of and Access to Nature) for more information.

b. Furniture for relaxation and respite, especially in settings where staff are commonly scheduled to work extended and double shifts

c. A notification area to facilitate communication (e.g., human resources notices, resident passing, etc.)

d. Staff should have a dedicated outdoor space that is physically separate from outdoor spaces accessed by residents and visitors.

2.3-4.3.2.1 Staff lounge area(s) shall be permitted to be shared by more than one service.

*__2.3-4.3.2.2__ Staff lounge area(s) shall provide the following based upon the facility needs:

(1) Refrigerator

(2) Sink

(3) Space for microwave and other appliances

__A2.3-4.3.2.2__ Consideration should be given to long-term storage of food and other items for times when staff may stay at the facility for an extended period.

2.3-4.3.3 Staff Toilet Room

~~A2.3-4.3.3 Provision of shower facilities for staff should be considered.~~

2.3-4.3.5 Staff Shower

2.3-4.3.5.1 A shower and area to change clothes shall be provided for staff use.

2.3-4.3.5.2 This shower shall be permitted to be shared with residents if approved by the AHJ.

2.3-4.7.2 Receiving Areas

2.3-4.7.2.1 Where provided, a loading dock and receiving and breakout area(s) shall be permitted to be shared with other services.

***2.3-4.7.2.2** Deliveries to the building shall be limited to one specific entry point/receiving area.

> **A2.3-4.7.2.2** During infectious disease events, deliveries should be routed to a staging area for disinfection. Consideration should be given to accommodations for sorting and distributing supplies to limit the number of trips required and thereby reduce exposure of staff and residents.

***2.3-4.8.1 Waste Collection and Storage Facilities**

Facilities shall be provided for sanitary storage of waste and recyclables per local requirements that are separate from food preparation, personal hygiene, and other clean functions. See Section 2.2-2.5.1 (Storage and Collection of Recyclables and Discarded Goods) for additional requirements.

> **A2.3-4.8.1** Safe containment for linens, towels, and clothing that may be contaminated from bodily fluids should be provided. During infectious disease events, trash collected in infected areas should be contained

and separated from the remainder of the facility. Waste removed from an infected area should not pass through any other part of the building.

***2.3-4.10.6 Non-Refrigerated Body-Holding Room**

A2.3-4.10.6 A non-refrigerated body-holding room may be needed during times of pandemic or where immediate transfer of a body off-site is impractical.

2.3-4.10.6.1 Where provided, a non-refrigerated body-holding room shall meet the following requirements:

(1) The room shall be individually temperature controlled.

(2) The room shall maintain a negative pressure to adjacent areas.

(3) The room shall be provided with a minimum total of 10 air changes per hour.

(4) The room shall maintain a design temperature of 70-75 degrees Fahrenheit (21-24 degrees Celsius).

2.3-4.10.6.2 All exhaust air from a non-refrigerated body-holding room shall be discharged directly to the outdoors without mixing with air from any other room or exhaust system.

2.3-4.10.6.3 Air shall not be recirculated by means of a room unit.

Chapter 2.4 Design and Construction Requirements

***2.4-2.2.4.2 Door openings**

A2.4-2.2.4.2 Door openings. In-swinging, non-secured doors should have hands-free exit capability to enable

room exiting without having to touch the door. This is particularly important for self-closing doors.

2.4-2.2.8.5 Provisions for drying hands. Provisions for hand drying shall be required at all hand-washing stations.

(1) Hand-washing stations shall include a hand-drying device that does not require hands to contact the dispenser.

(2) These provisions shall be enclosed to protect against dust or soil and to ensure single-unit dispensing.

*(3) Hot air dryers shall be permitted unless the care population dictates otherwise. See Section 2.2-4 (Design Criteria for Dementia, Mental Health, and Cognitive and Developmental Disability Facilities) for specific care population requirements.

A2.4-2.2.8.5 (3) During an infectious disease event, hot air dryers should be temporarily disabled and single-use towels should be provided directly accessible to sinks but located to eliminate contact with splash from the sink.

(4) Where provided, hand towels shall be directly accessible to sinks.

Chapter 2.5 Building Systems

2.5-2.3.2 Hand-Washing Sinks

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2.5-2.3.2.3 Fittings

(1) The water discharge point of a hand-washing sink faucet shall be at least 8.5 inches (21.59 centimeters) above the bottom

of the basin for resident rooms/bathrooms and 10 inches (25.4 centimeters) above the bottom of the basin for all other locations.

(2) Hand-washing sinks used by care and nursing staff and food service staff shall have fittings—including single-lever or wrist blade devices that allow for hands-free operation.

(a) Blade handles used for this purpose shall be at least 4 inches (10.16 centimeters) in length.

(b) The location and arrangement of fittings shall provide the clearance required for operation of blade-type handles.

(c) Fixtures shall not be equipped with aerators but shall be permitted to have a non-aerating laminar flow device.

*(3) Sensor-regulated (electronic) faucets

(a) Sensor-regulated faucets shall meet user need for temperature and for length of time water flows.

(b) Electronic faucets shall be capable of functioning during loss of normal power.

(c) Sensor-regulated faucets with manual temperature control shall be permitted.

A2.5-2.3.2.3 (3) Where sensor-regulated (electronic) faucets are provided, aerators and polyvinylchloride fittings should be avoided. Water flow and temperature should be controllable. Consideration should be given to providing programmed purge cycles to avoid buildup of waterborne pathogens.

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*2.5-3.6 HVAC Filters

See the facility chapters in Parts 3 through 5 for requirements.

A2.5-3.6 Air-handling systems should be designed to be capable of accommodating high-efficiency filters that exceed required minimum MERV ratings.

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*2.5-5 Communications Systems

A2.5-5 Real-time locating system. Organizations should evaluate the need for real-time locating systems (RTLS) for resident and staff tracking to help with contact tracing.

a. Where provisions are made for RTLSs, consideration should be given to the Wi-Fi network, technology for room level location (e.g., ultrasound, infrared, Bluetooth), and coverage area.

b. RTLS server equipment should be located in the technology equipment room (TER).

c. RTLS edge equipment should be located in the technology equipment room.

2.5-5.1 General

*2.5-5.1.1 Application

Requirements for call systems, information systems, and telecommunication systems shall be based on the care population and provided in accordance with requirements in the facility chapters in Parts 3 through 5.

A2.5-5.1.1 Communications systems considerations for emergency events

a. Consideration should be given to location, access, availability, and placement of telecommunication and broadband access points (hard-wired and WiFi) to support flexibility prior to, during, and after a disaster

event. Strategically locating telecommunication and broadband access points can support additional functional and programmatic requirements during an emergency event.

b. Surge locations identified during planning should have access to telecommunication and broadband access points so they can function as an extension of the facility and connect to outside support services.

c. See appendix section A1.3-1 (Flexible site considerations for emergency events) for site planning considerations.

***2.5-5.1.2 Communications System Equipment Requirements**

A2.5-5.1.2 Exterior communication connection. Where provisions are made for an exterior communication connection (wall or pedestal mount for network and telephone), consideration should be given to location of the box and the following:

a. In-conduit fiber and copper connections should be provided from the technology equipment room to the exterior communication box.

b. The exterior communication box should be IP67-rated and UV-resistant, able to operate in applicable temperatures, and allow for quick connection to network and telephone services.

c. Power should be provided to the exterior communication box and separated from in-conduit communication lines.

2.5-9 Elevators

***2.5-9.1 General**

See the facility chapters in Parts 3 through 5 for requirements.

> **A2.5-9.1** Where multiple elevators are included in the building design, consideration should be given to dedicating one for staff and service that can be operated independently of resident and visitor use during an infectious disease event.

Chapter 3.1 Specific Requirements for Nursing Homes

***3.1-2.2 Resident Unit**

3.1-2.2.1 General

***3.1-2.2.1.1 Resident unit size.** See Section 3.1- 2.2.1.2 (Layout) for typical resident unit size in different types of nursing home models and appendix table A3.1-a (Nursing Home Care Model Characteristics) for additional information.

3.1-2.2.1.2 Layout

(1) In new construction, resident units shall be ~~arranged to avoid~~ designed to minimize unrelated travel through the units.

3.1-2.2.2 Resident Room

Each resident room shall meet the following requirements:

***3.1-2.2.2.1 Capacity**

(1) In new construction~~, maximum room capacity shall be two residents~~ the maximum number of beds per room shall be one unless the necessity of a two-bed arrangement has been demonstrated in the functional program. Two beds per room shall be permitted when approved by the authority having jurisdiction.

A3.1-2.2.2.1 ~~Single resident rooms with an individual toilet room are encouraged.~~ Evidence suggests that single-resident rooms decrease risks for medication errors, health care-acquired infections, resident anxiety, and incidents of aggressive behavior while improving resident sleep patterns and staff effectiveness. In two-bed rooms, consideration should be given to creating room configurations that maximize individual resident privacy, access to windows, and room controls and provide equivalent space for each resident (e.g., alcoves for each).

*(2) Where renovation work is undertaken and the present capacity is more than two residents, maximum room capacity after renovation shall be no more than two residence in accordance with CMS-3260-F, "Reform of Requirements for Long-Term Care Facilities."

A3.1-2.2.2.1 (2) On October 4, 2016, the Centers for Medicare & Medicaid Services (CMS) published a final rule on the "Reform of Requirements for Long-Term Care Facilities," CMS-3260-F, in the *Federal Register*. This rule revises the requirements that long-term care facilities must meet to participate in the Medicare and Medicaid reimbursement programs. Effective November 28, 2016, each resident room must have a maximum capacity of two residents and a dedicated bathroom with at least a toilet and sink. Look for guidance on room configurations to meet CMS requirements under the Resources tab on the FGI website.

(3) Companion rooms. A maximum of 10 percent of resident rooms shall be permitted to be companion rooms.

A3.1-2.2.2.1 (3) Companion rooms. These rooms are primarily designed for a couple or siblings who prefer to share a bedroom. Consideration should be given to a layout that allows for flexibility so that each person can have their own space or half the room could be used as a sitting area while the other part accommodates both beds or one large bed.

3.1-2.2.2.2 Space requirements…

*(3) Resident room accommodations. Accommodations provided for each resident room shall be accessible from a wheelchair or other resident-operated mobility device and include the following:

A3.1-2.2.2.2 (3) Consideration should be given to providing space to accommodate movable furniture that allows for in-room dining.

(a) Window

(b) Bed

*(c) Resident chair or recliner

***3.1-2.2.2.3 Window**

(1) See Section 2.4-2.2.6 (Windows) in addition to the requirements in this section.

(2) In renovated construction, beds shall be no more than two deep from windows.

A3.1-2.2.2.3 Window. Provision of operable windows to allow for direct fresh air exchange, especially during

periods of high infection risk (e.g., coronavirus or influenza) should be considered. See Section 2.2-4.2.1.6 (Operable windows) for information.

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*3.1-2.2.2.5 **Hand-washing station.** A hand-washing station shall be provided in each resident room.

A3.1-2.2.2.5 In new construction and major renovation projects, accommodation should be made for placement of either a temporary hand-washing station with access to hot and cold water and water discharge or a hand sanitation dispenser in a consistent location near the entrance to the bedroom without having to enter an adjoining toilet room. The location of a temporary hand-washing station should not limit access/egress requirements for the bedroom.

(1) Omission of this station shall be permitted in a single-bed or two-bed room where a hand-washing station is located in an adjoining toilet room that serves that room only.

(2) Design requirements

(a) For hand-washing station design details, see Section 2.4-2.2.8 (Hand-Washing Stations).

(b) For sink design, see Section 2.5-2.3.2 (Plumbing Fixtures—Hand-Washing Sinks).

(c) For casework details, see Section 2.4-2.4.2 (Casework, Millwork, and Built-Ins).

***3.1-2.2.4.1 Airborne Infection Isolation (AII) room**

…

*(3) The toilet room provided for each AII room shall include a shower.

A3.1-2.2.4.1 (3) Where a bedpan-washing/disposal device is provided, it should be placed in the AII toilet room.

…

(6) Special Design Elements

(a) Architectural Details

(i) AII room perimeter walls, ceiling, and floor, including penetrations, shall be constructed to prevent air exfiltration.

(ii) AII rooms shall have self-closing devices on all room exit doors.

*(iii) Surfaces shall be smooth with minimal variation caused by joints, seams, perforations, or crevices.

A3.1-2.2.4.1 (6)(a)(iii) Surfaces with a large number of joints, seams, perforations, or crevices are difficult to clean and can harbor bacteria or viruses. Resilient flooring is preferred for cleanability.

(iv) Ceilings

- Ceilings shall be cleanable with routine housekeeping equipment.
- Ceiling finishes shall be scrubbable, non-absorptive, non-perforated, and capable of withstanding cleaning with chemicals.
- Acoustic and lay-in ceilings, where used, shall not create ledges or crevices.
- Where a lay-in ceiling is provided, it shall be gasketed

or each ceiling tile shall weigh at least one pound per square foot.

- Use of perforated, tegular, serrated, or highly textured tiles shall not be permitted.

3.1-4.4.4 Visitation Room

3.1-4.4.4.1 General

(1) A room shall be provided for the purpose of facilitating safe visitation.

(2) Use of visitation rooms for purposes other than visitation shall be permitted outside of flu season or other disease outbreaks.

3.1-4.4.4.2 Visitation room requirements

(1) Entry

(a) Separate entries shall be provided for visitors and residents.

(b) The visitor entry shall be accessed directly from the exterior or from an adjacent entry vestibule.

(2) Layout. The layout of the space shall allow for maintenance of 6 feet (1.8 meters) for physical distancing at all times during visitation.

(3) Visitation zones. Each visitation room shall be divided into three distinct zones:

(a) Resident zone. The resident zone shall be adjacent to the air return, which shall be located high above the resident zone.

(b) Neutral zone. The neutral zone shall provide a minimum 3-foot (91.44-centimeter) buffer between the resident and visitor zones.

(c) Visitor zone. The visitor zone shall be adjacent to the air exhaust.

(4) Airflow shall be designed to direct air movement from clean at the resident zone to dirty where the air is exhausted outside.

(5) Pressurization

(a) The visitation room shall be designed to function under negative pressure.

(b) Temporary equipment shall be permitted to create negative pressure in the room.

*(6) Carbon dioxide. Each visitation room shall be equipped with a monitoring device. This can be achieved with a carbon dioxide (CO_2) monitor indicating continuous directional airflow and maintenance of negative space pressurization.

A3.1-4.4.4.2 (6) Carbon dioxide monitoring. CO_2 monitors can provide an indication of successful ventilation operations. Exhaled air is the vehicle for infectious particles and contains almost 40,000 parts per million (ppm) of CO_2 compared with approximately 350 ppm in outdoor air. Carbon dioxide may be considered a surrogate for exhaled breath. Thus, the infraction of inhaled air that has been previously exhaled by a person can be easily determined. Caution and visitation termination should occur if CO_2 levels in the room exceed 700 ppm.

(7) Surfaces. Room surfaces shall be able to withstand frequent sanitation and wipe down after each visit.

3.1-4.6.2 Laundry Facility

*3.1-4.6.2.2 Where linen is processed in a laundry facility in the nursing home, the following shall be provided:

A3.1-4.6.2.2 During infectious disease events, consider providing accommodation for a separate laundry facility where potentially infectious soiled laundry can be managed and cleaned apart from the laundry for the remainder of the nursing home.

Chapter 3.2 Specific Requirements for Hospice Facilities

3.2-2.2 Resident Unit

…

3.2-2.2.1.2 Layout

(1) In new construction, hospice units shall be ~~arranged to avoid~~ designed to minimize unrelated travel through the unit.

…

3.2-2.2.2 ~~Resident~~ Hospice Patient Room

Each ~~resident~~ hospice patient room shall meet the following requirements:

***3.2-2.2.2.1 Capacity.** ~~Maximum room capacity shall be one resident unless justified in the functional program and approved by the AHJ, in which case hospice patient room capacity shall not exceed two resident beds.~~ The hospice patient room shall be single-occupancy unless the need for double-occupancy is justified in the functional program.

A3.2-2.2.2.1 Room size and capacity should include ~~Consideration should be given to~~ considerations for accommodating couples who may be ~~each~~ receiving hospice care either individually or at the same time.

***3.2-2.2.2.3 Window**

(1) See Section 2.4-2.2.6 (Windows) in addition to the requirements in this section.

(2) Provision shall be made for resident and family to completely darken the resident room.

A3.2-2.2.2.3 Window

a. Exterior windows should provide views to the natural environment and light where possible. Residents who are confined to their beds need a venue for visual stimulation. Plantings and other attempts to provide objects of visual interest should be made where exterior views of the natural environment are not possible due to existing building adjacencies. See Section 1.2-4.5.1 (Light) and Section 1.2-4.5.2 (Views of an Access to Nature) for additional information.

b. Provision of operable windows should be considered to allow for direct fresh air exchange, especially during periods of high infection risk (e.g., coronavirus or influenza). See Section 2.2-4.2.1.6 (Operable windows) for information.

***3.2-2.2.2.5 Hand-washing station.** A hand-washing station shall be provided in each ~~resident~~ hospice patient room.

A3.2-2.2.2.5 In new construction and major renovation projects, accommodation should be made for placement

of either a temporary hand-washing station with access to hot and cold water and water discharge or a hand sanitation dispenser in a consistent location near the entrance to the bedroom without having to enter an adjoining toilet room. The location of a temporary hand-washing station should not limit access/egress requirements for the bedroom.

(1) Omission of this station shall be permitted in a single-bed or two-bed room where a hand-washing station is located in an adjoining toilet room that serves that room only.

(2) Design requirements

(a) For hand-washing station design details, see Section 2.4-2.2.8 (Hand-Washing Stations).

(b) For sink design, see Section 2.5-2.3.2 (Plumbing Fixtures—Hand-Washing Sinks).

(c) For casework details, see Section 2.4-2.4.2 (Casework, Millwork, and Built-Ins).

3.2-4.4.4 Visitation Room

A visitation room shall be provided that meets the requirements in Section 3.1-4.4.4 (Nursing Homes—Visitation Room).

3.2-4.6.2 Laundry Facility

*__3.2-4.6.2.2__ Where linen is processed in a laundry facility in the hospice facility, the following shall be provided:

__A3.2-4.6.2.2__ During infectious disease events, consider providing accommodations for a separate laundry facility where potentially infectious soiled laundry can

be managed and cleaned apart from the laundry for the remainder of the hospice facility.

Chapter 4.1 Specific Requirements for Assisted Living Facilities

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***4.1-2.2.2.1 Capacity.** ~~Bedrooms shall be limited to single or double occupancy.~~ The assisted living resident room shall be single-occupancy unless the need for double-occupancy is justified in the functional program.

A4.1-2.2.2.1 Room size and capacity should include consideration for accommodating couples or siblings who may be receiving hospice care either individually or at the same time.

~~**A1.2-3.1.5.2 Evaluation of risks and opportunities to enhance quality of life**~~

***4.1-2.2.2.3 Windows**

A4.1-2.2.2.3 Windows. Provision of operable windows should be considered to allow for direct fresh air exchange, especially during periods of high infection risk (e.g., coronavirus or influenza). See Section 2.2-4.2.1.6 (Operable windows) for information.

4.1-4.4.4 Visitation Room

A visitation room shall be provided that meets the requirements in Section 3.1-4.4.4 (Nursing Homes—Visitation Room).

4.1-4.6.3 Laundry Facility

4.1-4.6.3.1 General

(1) When on-site laundry services are provided, the requirements in this section shall apply.

*(2) Facilities for processing shall be permitted to be located in the facility or in a separate building.

> **A4.1-4.6.3.1 (2)** During infectious disease events, consider providing accommodations for a separate laundry facility where potentially infectious soiled laundry can be managed and cleaned apart from the laundry for the remainder of the assisted living facility.

Chapter 4.2 Specific Requirements for Independent Living Settings

***4.2-4.4 Support Facilities for Family and Visitors**

...

4.2-4.4.3 Reserved

4.2-4.4.4 Visitation Room

A visitation room shall be provided that meets the requirements in Section 3.1-4.4.4 (Nursing Homes—Visitation Room).

Chapter 4.3 Specific Requirements for Long-Term Residential Substance Abuse Treatment Facilities

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~~*~~4.3-2.2.2 Resident Room

~~**A4.3-2.2.2 Resident room capacity.** Bedrooms should be limited to single or double occupancy.~~

4.3-2.2.2.1 ~~Reserved~~ Resident room capacity. The resident room shall be single-occupancy unless the need for double-occupancy is justified in the functional program.

***4.3-2.2.2.3 Windows**

A4.3-2.2.2.3 Window. Provision of operable windows should be considered to allow for direct fresh air exchange, especially during periods of high infection risk (e.g., coronavirus or influenza). See Section 2.2-4.2.1.6 (Operable windows) for information.

***4.3-2.2.2.5 Hand-washing station.** Where a hand-washing station is provided, see Section 2.4-2.2.8 (Hand-Washing Stations) for requirements.

A4.3-2.2.2.5 In new construction and major renovation projects, accommodation should be made for placement of either a temporary hand-washing station with access to hot and cold water and water discharge or a hand sanitation dispenser in a consistent location near the entrance to the bedroom without having to enter an adjoining toilet room. The location of a temporary hand-washing station should not limit access/egress requirements for the bedroom.

4.3-4.4 Support Facilities for Family and Visitors

4.3-4.4.2 – 4.3-4.4.3 Reserved

4.3-4.4.4 Visitation Room

A visitation room shall be provided that meets the requirements in Section 3.1-4.4.4 (Nursing Homes—Visitation Room).

4.3-4.6 Laundry Facility

***4.3-4.6.1 General**

A4.3-4.6.1 Based on the care model, laundry services may be centralized in the facility, decentralized using personal laundry facilities, and/or outside contracted services. See Section 2.3-4.2.7 (Personal Laundry Facilities) for additional information. Completing laundry may be part of the resident's responsibilities, depending on the care population of the therapeutic community. During infectious disease events, consider providing accommodations for a separate laundry facility where potentially infectious soiled laundry can be managed and cleaned apart from the laundry for the remainder of the substance abuse treatment facility.

Chapter 4.4 Specific Requirements for Settings for Individuals with Intellectual and/or Developmental Disabilities

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4.4-4.4.4 Visitation Room

A visitation room shall be provided that meets the requirements in Section 3.1-4.4.4 (Nursing Homes—Visitation Room).