ASPR TRACIE Technical Assistance Request

Request Receipt Date (by ASPR TRACIE): 19 September 2023
Response Date: 20 September 2023
Type of TA Request: Standard

Request:

The requestor asked for resources that can help planners rebuild resilient hospitals after storm damage.

Response:

ASPR TRACIE conducted a search online for resources related to hospital design and infrastructure resilience, including those in the ASPR TRACIE Climate Change and Healthcare System Considerations, Natural Disasters, and Recovery Planning Topic Collections. The following section provides relevant resources.

I. Select Resources

American Meteorological Society. (2014). A Prescription for the 21st Century: Improving Resilience to High-Impact Weather for Healthcare Facilities and Services.

> This report shares workshop findings on increasing and improving the resilience of health care facilities and services to high-impact weather events. The workshop grouped their findings into three main categories: hardening structures, making incremental adaptations, and implementing innovative practices.

Arnold, C., Holmes, W., Quinn, R., et al. (2007). Design Guide for Improving Hospital Safety in Earthquakes, Floods, and High Winds. Federal Emergency Management Agency.

> This design guide can inform and help design professionals, hospital administrators, and facility managers employ sound mitigation measures that will decrease the vulnerability of hospitals to disruptions from natural hazard events (e.g., earthquakes, high wind events, floods).

ASPR TRACIE. (2022). Innovations in Hospital Design-Penn Med Pavilion.

> Stephen Greulich, Assistant Vice President, Capital Projects Real Estate, Design & Construction; Denise Vaughn, Corp Information Services Program Plan Director, IS-Project Management Office; and Alyson Cole, Associate Executive Director, Transition and Occupancy Planning, Hospital of the University of Pennsylvania share information

on the design and construction, patient-led care technology, operational readiness, and sustainability of the new Penn Medicine campus in West Philadelphia.

Banatin, C. and Go, M. (2010). Safe Hospitals in Emergencies and Disasters: Structural, Non-Structural and Functional Indicators. World Health Organization, Regional Office for the Western Pacific.

This vulnerability assessment highlights structural, non-structural, and functional elements that must be considered to ensure that a health facility can withstand and remain operational in emergencies.

Budds, D. (2016). Designing A Disaster-Proof Hospital. Fast Company

The author, an architect, describes how the Southeast Louisiana Veterans Healthcare System was rebuilt by applying the lessons learned from that disaster as well as unique needs of veterans. Key features of the new hospital are meant to ensure that it can continue operations for up to 5 days post-disaster impact, including placement of the Emergency Room on the second floor; placing the generator fill line above the 500-year flood line; placing the generator underground; and placing the power grid on the fourth floor of the hospital.

Federal Emergency Management Agency. (2013). Earthquake Mitigation for Hospitals.

The materials from this workshop can help hospital administrators and facility managers identify opportunities to implement seismic mitigation in their facilities.

Fentem, S. (2018). 7 Years After Joplin Tornado, Mercy Builds Hospitals with Disaster in Mind.

The 2011 Joplin tornado decimated St. John's Hospital. This article describes how builders designed an addition to a different hospital (Mercy, in Festus, MO) to withstand storm damage. Builders used window glass that can withstand winds greater than 100 miles per hour; encased power sources in the attic; reinforced stairwells; and built a wall around the perimeter to protect the hospital from floodwater.

Guenther, R., and Balbus, J. (2014). Primary Protection: Enhancing Health Care Resilience for a Changing Climate. U.S. Department of Health and Human Services.

This 86-page document is a guide and toolkit designed to assist health care providers, design professionals, policymakers, and others with roles and responsibilities in assuring the continuity of quality health and human care before, during, and after extreme weather events. It is focused on health care infrastructure resilience to climate change impacts as manifested primarily by extreme weather events.

Iddona, C.R., Mills, T.C., Giridharand, R., and Lomas, K.J. (2015) The Influence of Hospital Ward Design on Resilience to Heat Waves: An Exploration Using Distributed Lag Models. Energy and Buildings. 86: 573-588.

The authors use models to measure the resilience of different medical building types to excessive heat. They found that masonry and Nightingale wards (a large room without subdivisions) fared better than rooms in light-weight modular buildings.

Krauskopf, R. and Saavedra, R. (2004). Guidelines for Vulnerability Reduction in the Design of New Health Facilities. World Health Organization, Pan American Health Organization.

This 106-page document provides information about three potential levels of protection for hospitals and health facilities from adverse events such as disasters, or performance objectives: life safety, investment protection, and functional protection.

Low, D., Mahadevia, A., Perotin, M., et al. (2013). Flood Proofing Non-Residential Buildings. Federal Emergency Management Agency.

This guidance document includes two hospital-specific case studies that illustrate the successful use of floodwalls.

Mercy Hospital Joplin. (2018). Temporary Hospital Buildout and Design: Floorplans.

These floorplans can help health care facility planners and builders erect temporary, hard-sided facilities to replace buildings damaged by disasters.

U.S. Department of Health and Human Services' Sustainable and Climate Resilient Health Care Facilities Initiative (SCRHCFI) (2016). Climate Resilient Health Care Facilities Toolkit.

This online toolkit can help health care facility planners learn more about implementing best practices in climate resilience. It is based on a framework composed of the following five elements: Climate Risks and Community Vulnerability Assessment; Land Use, Building Design, and Regulatory Context; Infrastructure Protection and Resilience Planning; Essential Clinical Care Service Delivery Planning; and Environmental Protection and Ecosystem Adaptations.

World Health Organization. (2009). Save Lives: Make Hospitals Safe in Emergencies.

This document discusses how to safeguard health facilities from natural disasters, how to retrofit existing facilities, and plan and train for emergencies.