TRACIE

HEALTHCARE EMERGENCY PREPAREDNESS INFORMATION GATEWAY

Healthcare Facility Evacuation/ Sheltering Topic Collection

10/7/2016

ASPR

ASSISTANT SECRETARY FOR PREPAREDNESS AND RESPONSE

Topic Collection: Healthcare Facility Evacuation/Sheltering

Past and recent disasters have illustrated the need for healthcare facilities to have solid evacuation and shelter-in-place plans for patients and staff alike. These plans must incorporate pre-established community incident command and management structures. Healthcare facility planners should also consider existing local plans and protocols while updating or creating memoranda of understanding with other hospitals and facilities, as necessary, for transfer and mutual aid during an emergency. In some circumstances, sheltering in place protocols may also be implemented as a necessary means of protecting facility occupants (patients, staff, and visitors) from external or internal threats (e.g., natural disasters and chemical, biological or nuclear events). In the recent past, major criminal acts (e.g., active shooters, civil disturbances, riots, and terrorism) in the community have had ramifications for hospital and healthcare facilities, such as causing the implementation of lock down procedures/ access controls. These factors should be considered and addressed when planning for sheltering in place. For more information, visit the ASPR TRACIE Topic Collection on Workplace Violence. *This Topic Collection was updated in October 2016.*

The resources in this Topic Collection include plans, guidelines, lessons learned from recent events, and promising practices that can help healthcare facility staff develop evacuation and sheltering plans, and facilitate their training and exercise development.

Each resource in this Topic Collection is placed into one or more of the following categories (click on the category name to be taken directly to that set of resources). Resources marked with an asterisk (*) appear in more than one category.

Must Reads

California Emergency Medical Services Authority, Hospital Incident Command System. (n.d.)
Incident Planning Guide: Evacuation, Shelter-in-Place, & Hospital Abandonment. (Accessed 9/28/2015.)

This guide addresses planning issues associated with evacuation, shelter-in-place, and hospital abandonment. Hospital emergency planners may customize it for their specific

requirements. It includes a checklist of items to ensure are included in a facility's emergency management program, including mitigation, preparedness, response, and recovery actions.

California Emergency Medical Services Authority, Hospital Incident Command System. (n.d.) Incident Response Guide: Evacuation, Shelter-in-Place, & Hospital Abandonment. (Accessed 9/28/2015.)

This guide addresses response issues associated with evacuation, shelter-in-place, and hospital abandonment. It includes action items for response starting from 0 hours of the incident to greater than 12 hours, and into demobilization and system recovery. Action items are broken down by Section and Branch Unit (of the Hospital Incident Command System).

California Hospital Association. (n.d.). Hospital Repopulation after Evacuation: Guidelines and Checklist. (Accessed 10/12/2015.)

The California Hospital Association worked with subject matter experts to identify best practices and regulatory agency requirements that have to be taken into account when repopulating after full or partial evacuation of general acute care hospital inpatient buildings. The guide includes a checklist that can be completed electronically or printed and filled out by hand.

Childers, A. (2010). Prioritizing Patients for Emergency Evacuation from a Healthcare Facility. Clemson University TigerPrints. All Dissertations. Paper 595.

This dissertation addresses the complex ethical decision-making process associated with hospital evacuation. The goal of this research is to develop a decision framework for prioritizing patient evacuations, where unique classifications of patient health, rates of evacuation, and survivability all impact the choice.

Dosa, D., Hyer, K., Thomas, K., et al. (2012). To Evacuate or Shelter In Place: Implications of Universal Hurricane Evacuation Policies on Nursing Home Residents. Journal of the American Medical Directors Association. 13(2): 190 e1-7.

The objective of this study was to examine the differential morbidity/mortality associated with evacuation versus sheltering in place for nursing home residents exposed to four hurricanes in the Gulf region. The authors discuss their methodology and results of the study. Among residents exposed to hurricanes, evacuation significantly exacerbated subsequent morbidity/mortality.

Downey, E.L, Andress, K., and Schultz, C.H. (2013). Initial Management of Hospital Evacuations Caused by Hurricane Rita: A Systematic Investigation. (Abstract only.) Prehospital and Disaster Medicine. 28(3):257-63.

The authors conducted a retrospective study on seven hospitals that either evacuated or sheltered in place during and after Hurricane Rita. They found that hospitals should plan for continuous patient arrival even during evacuation, and certain shortages (e.g., staff and food) when sheltering in place.

Fink, S. (2012). In Hurricane's Wake, Decisions Not to Evacuate Hospitals Raise Questions. ProPublica.

The author of this article describes the evacuating/ sheltering experiences of several New York City hospitals during Hurricane Sandy, and how hospital executives and the New York State Health Commissioner made evacuation decisions.

Florida Department of Health. (2011). Hospital Emergency Evacuation Toolkit.

This resource serves as a guidance document for the development of hospital-specific emergency evacuation response plans. The overall goal is to ensure that required evacuations are conducted in a planned, orderly, and consistent manner from hospital to hospital while ensuring sound patient care management throughout the evacuation. The toolkit also provides strategies for effective and efficient staff and patient re-entry processes. Planning checklists for advance-warning evacuation are included along with detailed information about lift/carry techniques and technologies.

Florida Health Care Association. (2008). National Criteria for Evacuation Decision-Making in Nursing Homes.

This resource provides criteria for evacuation decision-making in nursing homes and is intended to assist administrators and healthcare professionals determine whether to evacuate or shelter-in-place during disasters. It also includes guidance on the evacuation process.

Grimm, D. (n.d.). Evacuation Planning for Healthcare Facilities. (Accessed 10/12/2015.) BCFS Health and Human Services.

The author reviews evacuation history for healthcare facilities in disasters, examines issues related to evacuation planning, describes the difference between sheltering in place and evacuation, provides evacuation considerations, and addresses alternate care facilities and mutual aid evacuation planning.

Haggerty, E. (2013). When Bellevue Had to Evacuate Its Criminally Insane. Bedford and Bowery.

The author addresses having to evacuate patients with serious behavioral health issues, and highlights experiences and challenges faced by Bellevue Hospital in the aftermath of Hurricane Sandy.

Harvard School of Public Health Emergency Preparedness and Response Exercise Program (HSPH-EPREP), and Emergency Preparedness Bureau at the Massachusetts Department of Public Health. (2012). MDPH Hospital Evacuation Toolkit.

This toolkit is designed to assist hospitals as they review and update their plans annually for partial or full evacuation. It provides multiple guidance documents (e.g., staffing, assembly point, emergency receiver), and a hospital evacuation plan checklist.

Los Angeles County Emergency Medical Services Agency. (2012). Evacuation and Shelter-in-Place Guidelines for Healthcare Entities.

This guidance document is comprised of three parts. Part I provides general guidance on the differences between evacuation and shelter in place, including the roles and responsibilities of healthcare facilities and the healthcare system. Part II includes an evacuation and shelter in place plan template that healthcare facilities can use to create or update their own plan. Part III includes a set of two tabletop exercises (shelter in place and evacuation) that facility emergency planners may use in the planning phase as they develop their plans to identify needs, gaps, or solutions, and/or may use to educate personnel on the components of their existing plan.

Pandolfo, J. (2014). Comprehensive Planning for Emergency Evacuation of Healthcare Facilities. Patient Safety and Quality Healthcare.

The author provides a to-do list for developing a healthcare evacuation plan and notes that creating a plan will ensure patient safety during an emergency and increase buy-in from the staff and management.

Sternberg, E., Lee, G.C., and Huard, D. (2004). Counting Crises: US Hospital Evacuations, 1971-1999. (Abstract only.) Prehospital and Disaster Medicine. 19(2):150-7.

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Verni, C. (2012). A Hospital System's Response to a Hurricane Offers Lessons, Including the Need for Mandatory Interfacility Drills. Health Affairs. (8):1814-21.

This case study explores the lessons learned when the North Shore-Long Island Jewish Health System evacuated three hospitals at high risk of flooding from Hurricane Irene in August 2011. The event resulted in the evacuation, transport, and placement of 947 patients without any resulting deaths or serious injuries. This case demonstrates the utility of having a functional evacuation plan in place, such as the one North Shore-Long Island Jewish Health System developed through its own full-scale exercises in the years following Hurricane Katrina in 2005.

Wapling, A., Heggie, C., Murray, V., et al. (2009). Review of Five London Hospital Fires and Their Management: January 2008- February 2009. NHS London.

This report addresses the actions taken, including evacuation of facilities, and lessons learned from five major hospital fires that occurred in London over a 13 month period.

Zane, R., Biddinger, P., Hassol, A., et al. (2010). Hospital Evacuation Decision Guide. Agency for Healthcare Research and Quality.

This guide was created to assist hospitals in evaluating the factors that influence the decision to evacuate a facility, and can serve as a supplement to the hospital's emergency plan. It includes a Pre-Disaster Hospital Self-Assessment and discussions of both pre- and post-event evacuation decision-making.

Education and Training

Grimm, D. (n.d.). Evacuation Planning for Healthcare Facilities. (Accessed 10/12/2015.) BCFS Health and Human Services.

The author reviews evacuation history for healthcare facilities in disasters, examines issues related to evacuation planning, describes the difference between sheltering in place and evacuation, provides evacuation considerations, and addresses alternate care facilities and mutual aid evacuation planning.

McGinley, L., and Burich, D. (2012). Healthcare Facility Shelter-in-Place or Evacuation Webinar. (Requires free registration.) Yale New Haven Health System, Center for Emergency Preparedness and Disaster Response.

This webinar discusses decisions affecting healthcare facilities regarding who can stay and who must be evacuated in the event of a natural disaster, and how those decisions are made. It covers the impacts of selected hazards on facilities, a case study of a power system failure, and HAZUS risk assessment.

Minnesota Department of Health. (n.d.). Healthcare Facility Sheltering, Relocation, and Evacuation. (Accessed 10/12/2015.)

This PowerPoint presentation highlights a jurisdiction's lessons learned from recent events that necessitated hospital evacuation. It includes strategies for decision making, patient triage, tracking patients and residents, and planning. It also includes definitions of the terms associated with hospital evacuation and a printable slide of "disaster tags" that can be placed on a patient's belongings, wrists, and door.

Minnesota Department of Health. (n.d.). Healthcare Facility Training Matrix for Sheltering, Relocation, and Evacuation. (Accessed 10/12/2015.)

This PowerPoint presentation explains how the Minnesota Department of Health trains staff in sheltering, relocation, and evacuation. Staff are placed into one of three categories (all staff, operations, or command staff) and the training is tailored to these groups. A sheltering, relocating, and evacuation decision tree is also included.

*Natarajan, N. (n.d.) Coastal Storm Planning, the Healthcare Facility Evacuation Center (HEC), and Patient Tracking. (Accessed 10/12/2015.) New York State Department of Health, Office of Health Emergency Preparedness.

This presentation provides a history of the Healthcare Facility Evacuation Center (HEC) and describes the main objectives of the HEC. It also identifies challenges and describes the events that took place when New York hospitals evacuated during Hurricanes Irene and Sandy.

*Virginia Department of Health. (2013). Don't Sweat It: Preparing for Disasters in Nursing Homes and Assisted Living Facilities.

This video was developed to be an educational tool for staff training on emergency preparedness specific to long-term care facilities. The scenario follows staff as they deal with a major storm that causes a week-long power outage. The video covers topics including preparedness, sheltering in place, and evacuation.

Exercise Materials

Alameda County HealthCare Services Agency. (2015). Alameda County Disaster Preparedness Health Coalition Table Top Exercise Situation Manual.

This Situation Manual from Alameda County (CA) provides exercise participants with the tools to implement and evaluate the disaster preparedness health coalition tabletop exercise. The purpose of this exercise was to test the region's medical surge and communication capabilities following an earthquake in which several healthcare facilities were evacuated. The manual can be replicated by others interested in carrying out similar exercises.

Georgia Health Care Association Emergency Preparedness Committee. (2014). Tornado Tabletop Exercise Template.

This template provides exercise leaders and participants with the tools to implement and evaluate a tabletop exercise related to a tornado scenario. The purpose of this exercise was to provide facility leaders with a useful exercise to address tornado threats, issues, and concerns. It also allowed participants to address key issues through a series of self-facilitated discussions, including the evacuation of healthcare facilities. These materials can be replicated by others interested in carrying out similar exercises.

*Health Care Association of New Jersey. (2012). Mid Summer's NightMARES: Situation Manual.

This Situation Manual provided exercise participants in New Jersey with the tools to implement and evaluate the tabletop exercise related to long-term care facilities. The purpose of this exercise was to provide participants with an opportunity to evaluate their long-term care facility's current medical surge capabilities in response to a severe weather event. It focused on the implementation and coordination of internal emergency management plans, policies and procedures, critical decision making, communications capabilities and the ability to manage a disaster situation requiring medical surge or evacuation of residents into the facility's operations.

*Illinois Emergency Medical Services for Children. (2013). NICU/Nursery Evacuation Tabletop Exercise Toolkit.

This toolkit provides various resources and tools developed specifically for exercises, and offers guidance on planning, conducting, and evaluating tabletop exercises focused on the neonatal intensive care unit and nursery population.

*U.S. Department of Health and Human Services (HHS) Office of the Assistant Secretary for Preparedness and Response (ASPR), Hospital Preparedness Program. (2010). Situation Manual (SitMan): Long Term Care Facility Shelter-In-Place/ Evacuation Tabletop Exercise.

This Situation Manual includes exercise materials from Michigan, where exercise participants were given the tools to implement and evaluate the Long Term Care Facility (LTC) tabletop exercise. The purpose of this exercise was to provide a forum for LTCs and other organization to participate in a facilitated discussion regarding their roles and responsibilities during shelter-in-place and evacuation emergencies.

U.S. Department of Homeland Security. (n.d.). Ohio Central Region Hospital Evacuation and Shelter-in-Place Tabletop Exercise. (Accessed 10/14/2015.)

These exercise materials from Ohio's Central Region Hospitals provided participants with the tools to implement and evaluate a tabletop exercise related to an evacuation and shelter-in-place event scenario. The purpose of this exercise was to provide participants with an opportunity to evaluate the hospitals' current response concepts, plans, and capabilities. Patient tracking, overall movement (internal and externally to receiving facilities) notifications, and communications were also be evaluated.

Evaluation and Studies

Adalja, A.A., Watson, M., Bouri, N., et al. (2014). Absorbing Citywide Patient Surge during Hurricane Sandy: A Case Study in Accommodating Multiple Hospital Evacuations. (Abstract only.) Annals of Emergency Medicine. 64(1):66-73.

The authors of this study conducted interviews with 71 key staff from four hospitals in New York City after Hurricane Sandy to identify medical surge strategies used. More specifically, these hospitals received patients from evacuated healthcare facilities during and after the hurricane. Results indicated that there were improvement opportunities in the following areas: prolonged increased patient volume, an increase in the number of methadone and dialysis patients, ability to absorb displaced staff, the challenges associated with nursing homes that have evacuated and shelters that have already reached capacity, and reimbursements for transferred patients.

Bagaria, J., Heggie, C., Abrahams, J., and Murray, V. (2009). Evacuation and Sheltering of Hospitals in Emergencies: A Review of International Experience. (Abstract only.) Prehospital and Disaster Medicine. 24(5):461-7.

The authors of this article discuss the results of a scoping exercise, which was conducted to establish how common hospital evacuations are, identify hospital evacuation policies and review case studies to identify triggers, and identify processes and challenges involved in the evacuation of hospitals globally.

Childers, A. (2010). Prioritizing Patients for Emergency Evacuation from a Healthcare Facility. Clemson University TigerPrints. All Dissertations. Paper 595.

This dissertation addresses the complex ethical decision-making process associated with hospital evacuation. The goal of this research is to develop a decision framework for prioritizing patient evacuations, where unique classifications of patient health, rates of evacuation, and survivability all impact the choice.

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The objective of this study was to examine the differential morbidity/mortality associated with evacuation versus sheltering in place for nursing home residents exposed to four hurricanes in the Gulf region. The authors discuss their methodology and results of the study. Among residents exposed to hurricanes, evacuation significantly exacerbated subsequent morbidity/mortality.

Downey, E.L., Andress, K., and Schultz, C.H. (2013). External Factors Impacting Hospital Evacuations Caused by Hurricane Rita: The Role of Situational Awareness. (Abstract only.) Prehospital and Disaster Medicine: 28(3): 264-271.

The authors examined the effect situational awareness had on hospitals' decision to evacuate or shelter in place during and after Hurricane Rita. They found that incident management teams reported two main factors that guided decisions: (1) the effect of the incident on the facility's internal resources and challenges; and (2) how the incident characteristics would affect external evacuation activities.

Downey, E.L, Andress, K., and Schultz, C.H. (2013). Initial Management of Hospital Evacuations Caused by Hurricane Rita: A Systematic Investigation. (Abstract only.) Prehospital and Disaster Medicine. 28(3):257-63.

The authors conducted a retrospective study on seven hospitals that either evacuated or sheltered in place during and after Hurricane Rita. They found that hospitals should plan for continuous patient arrival even during evacuation, and certain shortages (e.g., staff and food) when sheltering in place.

*Femino, M., Young, S., and Smith, V. (2013). Hospital-Based Emergency Preparedness: Evacuation of the Neonatal Intensive Care Unit-The Smallest and Most Vulnerable Population. (Abstract only.) Pediatric Emergency Care. 29(1):107-13.

The authors describe a full-scale neonatal intensive care unit evacuation exercise and emphasize the importance of constant, clear communication.

Gray, B.H., and Hebert, K. (2007). Hospitals in Hurricane Katrina: Challenges Facing Custodial Institutions in a Disaster. (Abstract only.) Journal of Health Care for the Poor and Underserved. 18(2):283-98.

This report is based on interviews with hospital executives, public officials, leaders of trade associations, and others with firsthand experience of the flooding in New Orleans. It addresses what happened in New Orleans-area hospitals during and after Hurricane Katrina and why hospitals had such varied experiences. The authors conclude with lessons based on the Katrina experience.

Gildea, J.R., and Etengoff, S. (2005). Vertical Evacuation Simulation of Critically Ill Patients in a Hospital. (Abstract only.) Prehospital and Disaster Medicine. 20(4):243-8.

This study addresses the vertical evacuation of 12 simulated critically ill patients from the fourth floor of a newly constructed and vacant critical care unit by local fire fighters, on-staff nursing, residents, and ancillary staff, all under the direction of the hospital Emergency Management Committee. Several teams, dressed in full turnout gear, were timed and had their vital signs assessed prior to ascending to the fourth floor to retrieve a patient and upon each subsequent decent. This drill reflected an impressive level of preparedness by participants both physically and organizationally.

Hicks, J. and Click. R. (2015). A Meta-Analysis of Hospital Evacuations: Overcoming Barriers to Effective Planning. (Abstract only.) Journal of Healthcare and Risk Management. 34(3):26-36.

The authors of this study reviewed literature related to hospital evacuations over the past 30 years. The objectives of this study were: 1) to explain why hospital evacuation planning and preparation is important, and 2) to present the results of a thorough review of the literature. The authors share that the success or failure of hospital evacuations

generally fall into one or more of the following eight categories: Predisaster Assessment, Logistics, Communications, Community Relationships, Manual Records and Tracking, Resource Management, Special Patient Populations, and Postevacuation Return.

Iserson, K. (2013). Vertical Hospital Evacuations: A New Method. (Abstract only.) Southern Medical Journal. 106(1):37-42.

Evacuating non-ambulatory patients is challenging in non-disaster times, let alone during a crisis. This article describes how using available materials (e.g., mattresses and sheets) can help make vertical evacuation easier.

King, M.A., Dorfman, M.V., Einav, S., et al. (2015). Evacuation of Intensive Care Units during Disaster: Learning From the Hurricane Sandy Experience. (Abstract only.) Disaster Medicine and Public Health Preparedness. 0:1–8.

The authors of this study surveyed nurses, respiratory therapists, and physicians who played direct roles during the Hurricane Sandy intensive care unit (ICU) evacuations to learn about their experience and lessons learned related to preparedness efforts. Results indicated that ICU providers who evacuated critically ill patients during Hurricane Sandy had little prior knowledge of evacuation processes or vertical evacuation experience. The weakest aspects in the patient evacuation process were communication and the availability of practical tools.

Park, Y., Abramson, D., and Levin, K. (2012). Assessing the Reliability and Validity of the Evacuation Support Decision Tool. Columbia University, Earth Institute, National Center for Disaster Preparedness.

This study examines the reliability and validity of the Evacuation Decision Support Tool, which is designed to provide healthcare facilities, emergency managers, and other agencies with a systematic process to evaluate and guide "evacuation" versus "shelter in place" decision making for a variety of all hazards situations. The study used three standardized scenarios (power failure, ice storm, and hurricane) across five standardized situations (communications failure, critical supply shortage, electrical utility power failure, external flood, and internal flood).

Ricci, K.A., Griffin, A.R., Heslin, K.C., et al. (2015). Evacuate or Shelter-in-place? The Role of Corporate Memory and Political Environment in Hospital-evacuation Decision Making. (Abstract only.) Prehospital and Disaster Medicine. (3):233-8.

The authors conducted this study to identify factors that most heavily influenced the decisions to evacuate the U.S. Department of Veterans Affairs New York Harbor Healthcare System's Manhattan Campus before Hurricane Irene in 2011 and before Superstorm Sandy in 2012. The most influential factor in the decision to evacuate was New York City's hospital-evacuation mandate. Results indicated that hospital evacuation decisions are confounded by political considerations and are influenced by past disaster experience.

Rimstad, R., and Holtan, A. (2015). A Cross-Sectional Survey of Patient Needs in Hospital Evacuation. (Abstract only.) Journal of Emergency Management. 13(4):295-301.

The authors conducted a study of a hospital's inpatient needs in the event of a total evacuation within a few hours. As part of the study, a doctor or nurse on each ward registered patients' physical mobility, any special needs complicating transportation (e.g., intensive care, labor, or isolation), and the lowest acceptable level of care after evacuation. Of the 760 included patients, more than half could walk, and nearly 20% either needed a wheelchair or transport on stretcher. Special needs were registered for 18.2% of patients. Close to 50% of patients needed to be evacuated to another hospital to continue care on an acceptable level. The manual can be replicated by others interested in carrying out similar exercises.

Sternberg, E., Lee, G.C., and Huard, D. (2004). Counting Crises: US Hospital Evacuations, 1971-1999. (Abstract only.) Prehospital and Disaster Medicine. 19(2):150-7.

The authors reviewed various types of articles to determine causes for hospital evacuations and found that more than half were due to hazards originating inside of the facility or from "human intruders." They emphasize the need for data gathering and reporting to facilitate the calculation of national data.

Taaffe, K., Johnson, M., and Steinmann, D. (2006). Improving Hospital Evacuation Planning Using Simulation. Department of Industrial Engineering, Clemson University.

The authors of this report address the development of a simulation model and initial analysis to assess the effectiveness of an evacuation plan given different scenarios and resources. This is a promising first step towards developing a resource/ time model that could be refined and broadened by future efforts.

Verni, C. (2012). A Hospital System's Response to a Hurricane Offers Lessons, Including the Need for Mandatory Interfacility Drills. Health Affairs. (8):1814-21.

This case study explores the lessons learned when the North Shore-Long Island Jewish Health System evacuated three hospitals at high risk of flooding from Hurricane Irene in August 2011. The event resulted in the evacuation, transport, and placement of 947 patients without any resulting deaths or serious injuries. This case demonstrates the utility of having a functional evacuation plan in place, such as the one North Shore-Long Island Jewish Health System developed through its own full-scale exercises in the years following Hurricane Katrina in 2005.

Vugrin, E.D., Verzi, S.J., Finley, P.D., et al. (2015). Modeling Evacuation of a Hospital without Electric Power. (Abstract only.) Prehospital and Disaster Medicine. (3):279-87.

The authors of this report describe a modeling case study of the 2001 evacuation of the Memorial Hermann Hospital in Houston, Texas. They used a model designed to track

such cascading events following loss of infrastructure services and to identify the staff, resources, and operational adaptations required to sustain patient care and/or conduct an evacuation.

Wapling, A., Heggie, C., Murray, V., et al. (2009). Review of Five London Hospital Fires and Their Management: January 2008- February 2009. NHS London.

This report addresses the actions taken, including evacuation of facilities, and lessons learned from five major hospital fires that occurred in London over a 13 month period.

Zoraster, R.M., Amara, R., and Fruhwirth, K. (2011). Transportation Resource Requirements for Hospital Evacuation. (Abstract only.) American Journal of Disaster Medicine. 6(3):173-86.

The authors of this study conducted a survey on 62 hospitals in Los Angeles County to assess occupancy and patient transportation needs, and to determine the most efficient deployment of limited transportation resources in the event of a hospital evacuation. This survey demonstrated that approximately 20% of hospital inpatients could be discharged home within a few hours; about 40% of hospital inpatients could be transported via vans, buses, or private cars; and the remaining 40% would need ambulance transportation for evacuation. Additionally, the survey provided information about the distribution of emergency department and intensive care unit patients and the resources they would require during a hospital evacuation.

Guidelines and Protocols

California Emergency Medical Services Authority, Hospital Incident Command System. (n.d.) Incident Planning Guide: Evacuation, Shelter-in-Place, & Hospital Abandonment. (Accessed 9/28/2015.)

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This resource provides criteria for evacuation decision-making in nursing homes and is intended to assist administrators and healthcare professionals determine whether to evacuate or shelter-in-place during disasters. It also includes guidance on the evacuation process.

*Illinois Emergency Medical Services for Children. (2009). Neonatal Intensive Care Unit (NICU) Evacuation Guidelines.

These neonatal intensive care unit (NICU) evacuation guidelines were developed by professionals throughout Illinois. A multi-disciplinary committee was also convened to collate personal experiences, recommendations, and current literature on NICU evacuations. This guide is intended to assist healthcare providers assess pre-event vulnerabilities and plan for the evacuation of medically fragile Level III NICU patients while addressing core components of incident management, in conjunction with the promotion of patient safety and evacuation procedures based on lessons learned from past disasters and experiences.

Jagnarine, S., Van Alphen, D., Gibbs, T., et al. (2014). Hospitals Don't Burn!: Hospital Fire Prevention and Evacuation Guide. World Health Organization, and Pan American Health Organization.

This guidance document was developed to address the vulnerability of hospitals to fires. It is intended that all possible steps should be taken to minimize the hazard of fires in hospitals and the need for evacuation. The guide is applicable to existing hospitals that

can be retrofitted to improve safety against fires, and proposed new-build facilities. It is formatted into four sections: Prevention, Suppression, Evacuation, and Training Drills.

*Los Angeles County Emergency Medical Services Agency. (2012). Evacuation and Shelter-in-Place Guidelines for Healthcare Entities.

This guidance document is comprised of three parts. Part I provides general guidance on the differences between evacuation and shelter in place, including the roles and responsibilities of healthcare facilities and the healthcare system. Part II includes an evacuation and shelter in place plan template that healthcare facilities can use to create or update their own plan. Part III includes a set of two tabletop exercises (shelter-in-place and evacuation) that facility emergency planners may use in the planning phase as they develop their plans to identify needs, gaps, or solutions, and/or may use to educate personnel on the components of their existing plan.

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Lessons Learned and Incident Analysis

Baldwin, S., Robinson, A., Barlow, P., et al. (2006). Moving Hospitalized Children All Over the Southeast: Interstate Transfer of Pediatric Patients during Hurricane Katrina. Pediatrics. 117: s416-420.

This article highlights the unique issues associated with the flooding and the subsequent need to evacuate neonates from New Orleans hospitals after Hurricane Katrina.

Bernard, M. and Mathews, P.R. (2008). Evacuation of a Maternal-Newborn Area during Hurricane Katrina. (Abstract only.) MCN-The American Journal of Maternal Child Nursing. 33(4):213-23.

The authors describe the efforts of the nursing team at Memorial Medical Center in New Orleans in caring for patients and providing for the evacuation of 16 critically ill

newborns from the Level 3 regional neonatal intensive care unit and 5 well newborns and their mothers after Hurricane Katrina.

Espiritu, M. (n.d.) The Vertical Evacuation of a Neonatal ICU During a Disaster: Lessons Learned at NYULMC During Hurricane Sandy. Northwest Healthcare Response Network. (Accessed 10/7/2016.)

This presentation focuses on lessons learned from the evacuation of the neonatal intensive care unit (NICU) of NYU Langone Medical Center during Superstorm Sandy in 2012. It also includes lessons learned from Tropical Storm Irene in 2011.

Fink, S. (2012). In Hurricane's Wake, Decisions Not to Evacuate Hospitals Raise Questions. ProPublica.

The author of this article describes the evacuating/ sheltering experiences of several New York City hospitals during Hurricane Sandy, and how hospital executives and the New York State Health Commissioner made evacuation decisions.

Fink, S. (2013). Five Days at Memorial: Life and Death in a Storm-Ravaged Hospital. (Book available for purchase.) Crown Publishers.

This award winning book is a narrative account of a hospital in crisis and provides many lessons related to incident command, communications, sheltering in place and evacuation of a hospital during Hurricane Katrina. This book is a "must-read" for all hospital emergency management staff and key clinical providers as a reminder of how decisions under stress can become distorted, and the importance of plans and processes during crisis.

Fuzak, J. K., Elkon, B.D., Hampers, L.C., et al. (2010). Mass Transfer of Pediatric Tertiary Care Hospital Inpatients to a New Location in Under 12 Hours: Lessons Learned and Implications for Disaster Preparedness. (Abstract only.) The Journal of Pediatrics. 157(1):138-143 e2.

The authors retrospectively evaluated the transfer of 111 patients 8.5 miles in 11.6 hours along parallel (vs series) circuits, allowing simultaneous movement of patients from different areas. The transfers were accomplished using 13 critical care teams, five general crews, two vans, and four other vehicles. This experience demonstrates the safety and efficiency of transferring patients in a parallel fashion.

Ginsberg, H.G. (2006). Sweating it Out in a Level III Regional NICU: Disaster Preparation and Lessons Learned at the Ochsner Foundation Hospital. Pediatrics. 117: s375-380.

The author of this article highlights the challenges and lessons learned associated with evacuating neonates from the New Orleans hospital after Hurricane Katrina.

Haggerty, E. (2013). When Bellevue Had to Evacuate Its Criminally Insane. Bedford and Bowery.

The author addresses having to evacuate patients with serious behavioral health issues, and highlights experiences and challenges faced by Bellevue Hospital in the aftermath of Hurricane Sandy.

Kanter, R.K. (2012). Regional Variation in Critical Care Evacuation Needs for Children after a Mass Casualty Incident. (Abstract only.) Disaster Medicine and Public Health Preparedness. 6(2):146-9.

The author modeled the ability of five New York state regions to accept 30 children after a mass casualty incident (MCI), and calculated the time to evacuate patients to PICU beds in other regions when surge exceeded capacity. He found that large metropolitan areas could best accommodate patients following a local MCI and serve as a critical resource to other regions if they need surge support. Ground transportation was found to be quickest for evacuations in large metropolitan areas, while helicopters may be best for areas distant from metropolitan areas.

Klein, K.R., and Nagel, N.E. (2007). Mass Medical Evacuation: Hurricane Katrina and Nursing Experiences at the New Orleans Airport. (Abstract only.) Disaster Management and Response. Apr-Jun;5(2):56-61.

The authors of this article describe the experiences and solutions of nurses and other personnel from three Disaster Medical Assistance Teams assigned to the New Orleans airport responsible for patient assessment, stabilization, and evacuation operation after Hurricane Katrina.

Lucile Packard Children's Hospital Standford. (2015). New System Aims to Simplify Patient Transfers in Emergency. Stanford School of Medicine.

This article discusses the Lucile Packard Children's Hospital Stanford electronic medical records system, which may make the transfer process of patients safer and more efficient in the event of an evacuation due to a major crisis (e.g., earthquake or power outage). Caregivers have access to an automated report that categorizes patients in terms of their specific needs (e.g., what types of intravenous medication they receive, whether they're on ventilators, or whether they need an intensive care unit bed). This system is part of a Stanford-designed program called TRAIN (Triage by Resource Allocation for Inpatients), which helps determine what vehicles and equipment are necessary for continuous patient care during a crisis event and simplifies communicating patients' needs to other hospitals or command centers coordinating transfers.

Uppal, A., Evans, L., Chitkara, N., et al. (2013). In Search of the Silver Lining. The Impact of Superstorm Sandy on Bellevue Hospital. ATS Journals. Volume 10, 2.

Staff members of the New York University (NYU) School of Medicine discuss their experience and lessons learned during the evacuation and closure of Bellevue Hospital after Superstorm Sandy and other past storms.

Plans, Tools, and Templates

*Assisted Living Federation of America. (n.d.). Emergency Preparedness Tool Kit. (Accessed 9/28/2015.)

This toolkit provides information and resources for assisted living facilities leadership, and can help them prepare and plan for events that may cause evacuation or sheltering in place. Appendices also include an employee survey for emergency help, evacuation policies and procedures, an evacuation agreement, an authorization to disclose health information, and an emergency preparedness checklist for senior living communities.

Author Redacted. (2012). Emergency Sheltering, Relocation, and Evacuation Plan.

This plan is designed to assist in activating sheltering, patient relocation, or partial or full evacuation of a healthcare facility. It provides action steps, and includes a decision tree to help guide facilities on whether to shelter, evacuate, or relocate. It also includes various templates and checklists (e.g., incident management staff checklists).

California Hospital Association. (2010). Hospital Evacuation Plan (Checklist).

This resource provides a checklist and decision tree, which can be used to guide hospitals in the development or update of an evacuation plan. It contains detailed information, instructions, and procedures that can be engaged in any emergency situation requiring hospital evacuation (full or partial), as well as sheltering in place.

*California Hospital Association. (n.d.). Hospital Repopulation after Evacuation: Guidelines and Checklist. (Accessed 10/12/2015.)

The California Hospital Association worked with subject matter experts to identify best practices and regulatory agency requirements that have to be taken into account when repopulating after full or partial evacuation of general acute care hospital inpatient buildings. The guide includes a checklist that can be completed electronically or printed and filled out by hand.

California Hospital Association. (2011). Hospital Shelter in Place Planning Checklist.

This resource provides a checklist and decision tree, which can be used to assist hospitals with developing, reviewing, or updating their shelter in place plans.

*Carbine, D., Cohen, R., Hopper, A., et al. (2014). Neonatal Disaster Preparedness Toolkit. California Association of Neonatologists.

This toolkit identifies major hazards faced by neonatal intensive care units in California and provides suggested mitigation and response planning strategies, including evacuation and sheltering in place. It also provides appendices with sample check lists, job action sheets, and information transfer sheets for specific hazards.

Continuum Health Partners. (2006). Evacuation Planning for Hospitals Draft Document. Health Resources and Services Administration.

This report summarizes findings from several Continuum Emergency Management Committee subcommittee meetings on comprehensive hospital evacuation planning. The subcommittee developed three task forces (facility task force, a patient care task force, and a support service task force) and each one created formal recommendations. The larger committee shares select recommendations in this document and explains how they can be applied for use by all hospitals in their evacuation planning.

*Florida Department of Health. (2011). Hospital Emergency Evacuation Toolkit.

This resource serves as a guidance document for the development of hospital-specific emergency evacuation response plans. The overall goal is to ensure that required evacuations are conducted in a planned, orderly, and consistent manner from hospital to hospital while ensuring sound patient care management throughout the evacuation. The toolkit also provides strategies for effective and efficient staff and patient re-entry processes. Planning checklists for advance-warning evacuation are included along with detailed information about lift/carry techniques and technologies.

*Florida Health Care Association. (2008). National Criteria for Evacuation Decision-Making in Nursing Homes.

This resource provides criteria for evacuation decision-making in nursing homes and is intended to assist administrators and healthcare professionals determine whether to evacuate or shelter-in-place during disasters. It also includes guidance on the evacuation process.

Harvard School of Public Health Emergency Preparedness and Response Exercise Program, and Emergency Preparedness Bureau at the Massachusetts Department of Public Health. (2012). MDPH Hospital Evacuation Toolkit.

This toolkit is designed to assist hospitals as they review and update their plans annually for partial or full evacuation. It provides multiple guidance documents (e.g., staffing, assembly point, emergency receiver), and a hospital evacuation plan checklist.

Ligthelm, T. J. (2010). Chapter 9. Hospital Impact: Internal Disasters. (Complete book available for purchase.) International Disaster Nursing. pp. 139-164. Cambridge University Press.

In Chapter 9 of this text book the author addresses a variety of common internal hospital emergencies and discusses evacuation-related planning and response issues.

*Los Angeles County Emergency Medical Services Agency. (2012). Evacuation and Shelter-in-Place Guidelines for Healthcare Entities.

This guidance document is comprised of three parts. Part I provides general guidance on the differences between evacuation and shelter in place, including the roles and responsibilities of healthcare facilities and the healthcare system. Part II includes an evacuation and shelter in place plan template that healthcare facilities can use to create or update their own plan. Part III includes a set of two tabletop exercises (shelter in place and evacuation) that facility emergency planners may use in the planning phase as they develop their plans to identify needs, gaps, or solutions, and/or may use to educate personnel on the components of their existing plan.

*Lucile Packard Children's Hospital. (n.d.) Preplanning Disaster Triage for Pediatric Hospitals: TRAIN TOOLKIT. (Accessed 9/28/2015.)

The Triage by Resource Allocation for IN-patient (TRAIN) matrix is a tool for pediatric hospital disaster "pre-planning" and an in-patient triage system designed to facilitate evacuation in a major crisis. It categorizes pediatric inpatients according to their resource transportation needs. It can be implemented manually or within an electronic medical record.

Minnesota Department of Health. (2012). Emergency Sheltering, Relocation, and Evacuation for Healthcare Facilities.

This emergency sheltering and evacuation template can be tailored by facility emergency planners. It includes 10 appendices on topics such as relocation, hospital incident command, and supplies.

Minnesota Department of Health. (n.d.). Medical Surge. (Accessed 10/7/15.)

The Minnesota Department of Health developed multiple resources to support planning for and conducting evacuations including long-term care and hospital evacuation planning templates; templates to train staff in sheltering, relocation, and evacuation by grouping them into one of three categories (all staff, operations, and command staff) with competencies by group; as well as algorithms to assist facility decision making during a potential evacuation.

*Natarajan, N. (n.d.) Coastal Storm Planning, the Healthcare Facility Evacuation Center (HEC), and Patient Tracking. (Accessed 10/12/2015.) New York State Department of Health, Office of Health Emergency Preparedness.

This presentation provides a history of the Healthcare Facility Evacuation Center (HEC) and describes the main objectives of the HEC. It also identifies challenges and describes the events that took place when New York hospitals evacuated during Hurricanes Irene and Sandy.

New York City Pediatric Disaster Coalition. (n.d.). Pediatric Disaster Coalition Neonatal Critical Care Surge Capacity Plan Template. (Accessed 10/7/2016.)

This customizable plan template focuses on increasing surge capacity and capabilities for the neonatal intensive care unit during evacuation.

New York State Department of Health. (2009). Comprehensive Emergency Management Plan Standard Content Elements for Hospital Evacuation Annex.

This planning document consists of 124 discrete elements, and is intended to create a single, all-inclusive set of parameters that define the State's criteria for shelter-in-place and evacuation procedures. Additional links to recent state guidance for facilities are also provided on the page.

Reeve, M., Altevogt, B., and Davis, M. (2015). Regional Disaster Response Coordination to Support Health Outcomes: Summary of a Workshop Series. Institute of Medicine.

Chapter 2 of this resource is titled, "Evacuation, Patient Tracking, and Information Sharing in a Regional Response." This chapter provides key points and challenges identified during a workshop series as it relates to the healthcare facility evacuation and patient tracking process during disaster.

Russell Phillips & Associates, LLC. (2008). Regional Medical Evacuation & Patient Tracking Mutual Aid Plan (MAP). Public Health Seattle and King County, and the King County Healthcare Coalition.

This document describes the Regional Medical Evacuation and Patient Tracking Mutual Aid Plan and includes algorithms for avoiding evacuation and evacuating a facility. It also provides strategies for post-evacuation patient placement and categorization.

South Carolina Department of Health and Environmental Control. (2014). SC Guide for Hospitals to Shelter-in-Place during a Hurricane.

This resource provides a framework for assessing the anticipated effects of a disaster event on key resources needed to care for patients (e.g., water, heat, electricity, staffing, and food), and the overall structural integrity of the building. Specific recommendations are listed for each of these factors, and will help identify a hospital's preparedness for sheltering in place.

Southern Maine Regional Resource Center. (2008). Hospital Evacuation Plan Template.

This template can be customized by emergency planners responsible for creating or updating healthcare facility evacuation plans.

*Stanford Medicine Obstetrics and Gynecology. (n.d.). Stanford OB Disaster Planning Toolkit. (Accessed 9/28/2015.)

A Stanford Health Care multidisciplinary committee, consisting of obstetricians, obstetrical anesthesiologist, labor and delivery and postpartum nurses, created and tested in a simulated setting, a compilation of tools that can be employed in the event of a hospital disaster requiring evacuation. This toolkit addresses the evacuation of labor and delivery and antepartum units, and includes shelter in place plans for actively laboring patients.

Special Populations: Long-Term Care and Assisted Living-Related Resources

*Assisted Living Federation of America. (n.d.). Emergency Preparedness Tool Kit. (Accessed 9/28/2015.)

This toolkit provides information and resources for assisted living facilities leadership, and can help them prepare and plan for events that may cause evacuation or sheltering in place. Appendices also include an employee survey for emergency help, evacuation policies and procedures, an evacuation agreement, an authorization to disclose health information, and an emergency preparedness checklist for senior living communities.

*Dosa, D., Hyer, K., Thomas, K., et al. (2012). To Evacuate or Shelter In Place: Implications of Universal Hurricane Evacuation Policies on Nursing Home Residents. Journal of the American Medical Directors Association. 13(2): 190 e1-7.

The objective of this study was to examine the differential morbidity/mortality associated with evacuation versus sheltering in place for nursing home residents exposed to four hurricanes in the Gulf region. The authors discuss their methodology and results of the study. Among residents exposed to hurricanes, evacuation significantly exacerbated subsequent morbidity/mortality.

*Florida Health Care Association. (2008). National Criteria for Evacuation Decision-Making in Nursing Homes.

This resource provides criteria for evacuation decision-making in nursing homes and is intended to assist administrators and healthcare professionals determine whether to evacuate or shelter-in-place during disasters. It also includes guidance on the evacuation process.

*Health Care Association of New Jersey. (2012). Mid Summer's NightMARES: Situation Manual.

This Situation Manual is an example of exercise materials from New Jersey, and provides exercise participants with the necessary tools to implement and evaluate the tabletop exercise related to long-term care facilities. The purpose of this exercise was to provide participants with an opportunity to evaluate their long-term care facility's current medical

surge capabilities in response to a severe weather event. It focused on the implementation and coordination of internal emergency management plans, policies and procedures, critical decision making, communications capabilities and the ability to manage a disaster situation requiring medical surge or evacuation of residents into the facility's operations.

*U.S. Department of Health and Human Services (HHS) Office of the Assistant Secretary for Preparedness and Response (ASPR), Hospital Preparedness Program. (2010). Situation Manual (SitMan): Long Term Care Facility Shelter-In-Place/ Evacuation Tabletop Exercise.

This Situation Manual is an example of exercise materials from Michigan, and provides exercise participants with the necessary tools to implement and evaluate the Long Term Care Facility (LTC) tabletop exercise (TTX). The purpose of the TTX was to provide a forum for LTCs and other organization to participate in a facilitated discussion regarding their roles and responsibilities during shelter-in-place and evacuation emergencies.

*Virginia Department of Health. (2013). Don't Sweat It: Preparing for Disasters in Nursing Homes and Assisted Living Facilities.

This video was developed to be an educational tool for staff training on emergency preparedness specific to long-term care facilities. The scenario follows staff as they deal with a major storm that causes a week-long power outage. The video covers topics including preparedness, sheltering in place, and evacuation.

Special Populations: Pediatric, NICU, and OB/ GYN-Related Resources

*Carbine, D., Cohen, R., Hopper, A., et al. (2014). Neonatal Disaster Preparedness Toolkit. California Association of Neonatologists.

This toolkit identifies major hazards faced by neonatal intensive care units in California and provides suggested mitigation and response planning strategies, including evacuation and sheltering in place. It also provides appendices with sample check lists, job action sheets, and information transfer sheets for specific hazards.

*Femino, M., Young, S., and Smith, V. (2013). Hospital-Based Emergency Preparedness: Evacuation of the Neonatal Intensive Care Unit-The Smallest and Most Vulnerable Population. (Abstract only.) Pediatric Emergency Care. 29(1):107-13.

The authors describe a full-scale neonatal intensive care unit evacuation exercise and emphasize the importance of constant, clear communication.

Graciano, A.L., and Turner, D. (2015). Current Concepts in Pediatric Critical Care. (Book available for purchase.) Society of Critical Care Medicine.

Chapter 16 of this book addresses pediatric preparedness, and specifically includes sections on the evacuation of pediatric intensive care units.

*Illinois Emergency Medical Services for Children. (2009). Neonatal Intensive Care Unit (NICU) Evacuation Guidelines.

These neonatal intensive care unit (NICU) evacuation guidelines were developed by professionals throughout Illinois. A multi-disciplinary committee was also convened to collate personal experiences, recommendations, and current literature on NICU evacuations. This guide is intended to assist healthcare providers assess pre-event vulnerabilities and plan for the evacuation of medically fragile Level III NICU patients while addressing core components of incident management, in conjunction with the promotion of patient safety and evacuation procedures based on lessons learned from past disasters and experiences.

*Illinois Emergency Medical Services for Children. (2013). NICU/Nursery Evacuation Tabletop Exercise Toolkit.

This toolkit provides various resources and tools developed specifically for exercises, and offers guidance on planning, conducting, and evaluating tabletop exercises focused on the neonatal intensive care unit and nursery population.

*Lucile Packard Children's Hospital. (n.d.) Preplanning Disaster Triage for Pediatric Hospitals: TRAIN TOOLKIT. (Accessed 9/28/2015.)

The Triage by Resource Allocation for IN-patient (TRAIN) matrix is a tool for pediatric hospital disaster "pre-planning" and an in-patient triage system designed to facilitate evacuation in a major crisis. It categorizes pediatric inpatients according to their resource transportation needs. It can be implemented manually or within an electronic medical record.

*Stanford Medicine Obstetrics and Gynecology. (n.d.). Stanford OB Disaster Planning Toolkit. (Accessed 9/28/2015.)

A Stanford Health Care multidisciplinary committee, consisting of obstetricians, obstetrical anesthesiologist, labor and delivery and postpartum nurses, created and tested in a simulated setting, a compilation of tools that can be employed in the event of a hospital disaster requiring evacuation. This toolkit addresses the evacuation of labor and delivery and antepartum units, and includes shelter in place plans for actively laboring patients.

Agencies and Organizations

Note: The agencies and organizations listed in this section have a page, program, or specific research dedicated to this topic area.

California Hospital Association. Hospital Evacuation.

Greater New York Hospital Association. Evacuation and Sheltering Issues.

Minnesota Department of Health. Medical Surge.

This ASPR TRACIE Topic Collection was comprehensively reviewed in September 2015 by the following subject matter experts (listed in alphabetical order): ***Eric Alberts****, BS, FPEM, CHS-V, CDP-1, CHPP, CHEP, SEM, CFRP, FABCHS, Manager, Emergency Preparedness, Orlando Health, Inc. (Hospital System);* ***Craig DeAtley****, PA-C, Grant Director, Director Institute for Public Health Emergency Readiness, Washington Hospital Center;* ***Aaron Gardner****, MD,MS, FAAP Regional Deputy Chief Medical Officer, HHS/ASPR/OEM/NDMS and Pediatric Intensivist, Eastern Idaho Regional Medical Center;* ***John Hick****, MD, HHS ASPR and Hennepin County Medical Center;* ***Mark Jarret****, MD, MBA, Chief Quality Officer, Associate Chief Medical Officer, North Shore-LIJ Health System;* ***Brad Learn****, Regional Healthcare Preparedness Coordinator, Kentucky Department for Public Health; and* ***Mary Russell****, EdD, MSN, Emergency Services, Boca Raton Regional Hospital.*

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