The Development of an Evacuation Protocol for Patients with Ventricular Assist Devices During a Disaster

Katherine J Davis, DNP, AGACNP-BC;[1] Joseph Suyama, MD;[1] Jennifer Lingler, PhD, CRNP;[2] Michael Beach, DNP, ACNP-BC, PNP[2]

1. University of Pittsburgh Medical Center, Pittsburgh, Pennsylvania USA
2. University of Pittsburgh School of Nursing, Pittsburgh, Pennsylvania USA

Correspondence:
Katherine Davis, DNP, AGACNP-BC
Suite 9D 23 200 Lothrop St
Pittsburgh, Pennsylvania USA 15213
E-mail: KJD523@gmail.com

Conflicts of interest: This manuscript was not supported by grant funding. The authors have no disclosures of conflicts of interests.

Keywords: disaster planning; preparedness; protocol; ventricular assist device

Abbreviations:
EMS: Emergency Medical Services
ICS: incident command centers
IOM: Institute of Medicine
NIMS: National Incident Management System
VAD: ventricular assist device

Received: April 26, 2016
Accepted: July 30, 2016

Online publication: March 16, 2017

doi:10.1017/S1049023X17000176

Abstract

Introduction: Health care providers are on the forefront of delivering care and allocating resources during a disaster; however, very few are adequately trained to respond in these situations. Furthermore, there is a void in the literature regarding the specific care needs of patients with ventricular assist devices (VADs) in a disaster setting. This project aimed to develop an evidenced-based protocol to aid health care providers during the evacuation of patients with VADs during a disaster.

Methods: This is a qualitative study that used expert review, tabletop discussion, and a survey of health care professionals to develop and evaluate an evacuation protocol. The protocol was revised after each stage of review in order to reach a consensus document.

Results: The project concluded with the finalization of a protocol which addresses evacuation and patient triage, and also includes an algorithm to determine which staff members should be evacuated with patients, transportation resources, evacuation documentation, and items patients need during evacuation. The protocol also addressed steps to be taken in the event that evacuation efforts fail and how to manage outpatient VAD patients seeking assistance.

Conclusions: This protocol provides guidance for the care of VAD patients in the event of a disaster and evacuation. Protocols such as this address difficult scenarios and should be created prior to a disaster to assist staff in making difficult decisions. These documents should be created using multi-disciplinary feedback via the consensus model as well as the Institute of Medicine (IOM; National Academy of Medicine; Washington, DC USA) "Crisis Standards of Care."

Davis KJ, Suyama J, Lingler J, Beach M. The development of an evacuation protocol for patients with ventricular assist devices during a disaster. *Prehosp Disaster Med*. 2017;32(3):333-338.

Introduction

In recent years, the public health community has witnessed many disasters which have led to chaos and destruction in various areas of the United States. While hurricanes are often the most memorable, bomb/terrorist threats, loss of power, flooding, and exposure to hazardous materials are also events that can necessitate the evacuation of patients.[1] The quality of response from health care organizations is often correlative to the level of preparedness and pre-planning of these institutions.[2-4] Given this correlation, and considering the many and wide-reaching forms that disasters can take, it is important that every health care facility in any location has a comprehensive plan for disaster situations.

The use of established protocols prior to catastrophic events can assist staff in making difficult decisions during disaster situations. Ethical and moral dilemmas affect all health care providers, particularly nurses. Nurses are at the forefront of decision making regarding patient care, rationing, and restrictions; yet, very few are properly trained for disaster management.[5,6] While it may be improbable to adequately train every nurse for all the difficult questions they may face when practicing in a disaster, creating protocols to guide decision making is a practical alternative. Protocols established for disaster circumstances enable hospitals to promote a standardization of care and operation consistency.[7]

The use of protocols during disasters has been shown to improve outcomes and reduce difficulties faced by health care providers. Without protocols and evaluation of care measures in catastrophes, there is a greater risk of poor coordination and communication between responders, reduced utilization of resources, and decreased patient access to life-saving care.[1,8] In order to prevent or alleviate complications of disasters, extensive planning and protocols need to be implemented prior to the occurrence of a disaster situation.[9]

A consensus document created by a task force of physicians through *CHEST Journal* (American College of Chest Physicians; Glenview, Illinois USA) suggests that triage protocols should be created to serve as clinical decision support systems.[10] They suggest that the use of triage protocols providing decision support will improve patient survival and resource allocation efficiency.[10] According to the Institute of Medicine's (IOM; National Academy of Medicine; Washington, DC USA) *Crisis Standards of Care*, protocols should be developed with multi-disciplinary and community engagement in order to promote transparency, accountability, consistency, and fairness.[11] Additionally, the use of decision support tools in traumatic disastrous situations has been shown to minimize moral distress among health care professionals.[12]

A large academic hospital in Western Pennsylvania (USA) did have a protocol that addressed disaster response; however, it did not detail the evacuation process of patients with ventricular assist devices (VADs), nor did it address difficult decisions that staff may encounter during these events. To fill this gap, the authors incorporated the recommendations of the IOM, CHEST task force, and Klein et al to develop an evidence-based evacuation protocol. The protocol is designed to function as a decision support system for the care and evacuation of VAD patients during a disastrous event. The protocol addresses the allocation of resources and ethical concerns that arise in evacuation scenarios. The effectiveness of the protocol was validated by a multi-disciplinary team in accordance with IOM standards of care using expert review, tabletop discussions, and surveys.

Methods

Setting

The project was conducted in a large academic hospital in urban Western Pennsylvania. The Artificial Heart Program (AHP; University of Pittsburgh Medical Center; Pittsburgh, Pennsylvania USA) follows the care of approximately 70 patients with VADs. Approximately seven to 15 patients are inpatient in the acute care setting on an average day. The protocol was developed and investigated on a 17-bed, cardio-thoracic surgical telemetry unit.

Design, Data Collection, and Analysis

An initial draft of the protocol was developed based on national disaster and crisis medicine guidelines set forth by the IOM, current literature and documentation of previous disaster experiences, and institutional guidelines regarding VAD patient transport.[11] The project culminated in the creation of a protocol which addressed evacuation, patient triage, an algorithm to determine which staff members should be sent with patients for assistance, transportation resources, evacuation documentation, and items patients need during evacuation. Also addressed was what should be done in the event that evacuation efforts fail, and how to address outpatient VADs seeking assistance. As described in the sections that follow, evaluation was conducted using three steps: (1) expert review; (2) tabletop discussion; and (3) health care provider survey. After each review, the protocol was edited until a consensus was created.

Initial expert review was provided by health care professionals from the clinical and academic setting. Experts included a physician with a background in disaster research and planning; a cardio-thoracic and VAD surgeon; a biomedical engineer involved in clinical management, research, and development of VADs; a cardio-thoracic nurse practitioner with experience working for a VAD development company and clinical management of patients with VADs; and a nurse practitioner that is also a professor of emergency medicine and disaster preparation and response. Reviewers provided oral and/or written feedback suggesting edits or areas needing further literature review. The protocol was revised based on feedback, and each updated version was re-submitted to all reviews for further consideration.

The tabletop discussion was conducted with seven registered nurses from the cardio-thoracic surgery unit. The nurses discussed disaster scenarios with and without the protocol. The discussion was recorded and analyzed by the authors for themes and identification of areas of the protocol that required amending.

The protocol was also assessed by a survey of interdisciplinary health care professionals that worked on the cardio-thoracic unit to be consistent with IOM recommendations. The protocol was rated on of 5-point Likert scale regarding readability, fairness, and congruence with crisis standards of care.

All feedback was individually reviewed by members of the study team. Recommendations and comments were compared to current disaster medicine literature before adjustments to the protocol were made. This project was approved by the University of Pittsburgh Medical Center's IRB and QI committees (Pittsburgh, Pennsylvania USA).

Results

Expert review of the protocol resulted in revisions in the sections on triage and simplification. For example, the number of groups for staff allocation was expanded to give a more detailed guidance to staff. The full protocol also was supplemented by the creation of a condensed and simplified version to be given to staff during a disaster event. The simplified version included checking a checklist to help staff with organization (Figure 1).

Themes that developed from the tabletop discussion of seven registered nurses included: fear of not having enough staff; ethical concerns regarding resource allocation and triage; and expression of the need for a simplified triage strategy. Revisions inspired by the tabletop discussion included presenting group allocation in algorithm form and an expanded section of the protocol in regards to ethical dilemmas.

The survey investigated whether health care professionals thought that the protocol was easy to understand, confusing, fair, easy to execute in a disaster, addressed realistic issues, and was congruent to crisis standards of care. Fifteen health care providers responded to the survey. All respondents agreed that the protocol was easy to understand, with 47% strongly agreeing. All respondents disagreed that the protocol was confusing, with 40% strongly disagreeing. Regarding whether the protocol was easy to execute during a disaster, one respondent disagreed, two were neutral, 10 agreed, and two strongly agreed. All respondents agreed that the protocol addressed realistic issues, with 47% strongly agreeing. Forty percent of respondents strongly agreed that the protocol was congruent to crisis standards of care, 53% agreed, and seven percent were neutral.

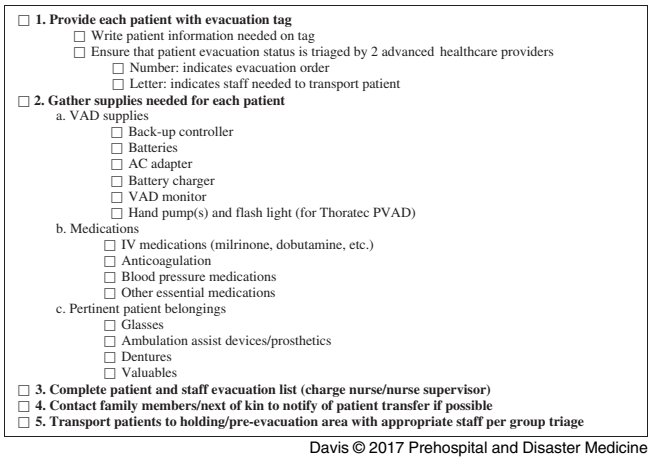

Figure 1. Simplified Protocol and Checklist.
Abbreviations: PVAD, paracorporeal assist device; VAD, ventricular assist device.

Protocol *(Appendix 1; available online only)*

Evacuation Decision

Hospitals should have incident command centers (ICS) with leaders from administrative and clinical departments. These members should be pre-chosen prior to a disaster event so that they may play an active role in planning, be familiar with protocols, and be trained in a National Incident Management System (NIMS)-compatible management system.[11,13,14] This team should have arrangements made with other facilities, Emergency Medical Services (EMS), and local and state governments to coordinate efforts in disaster, epidemic, and facility/local evacuations.[11]

Federal regulations specify that disaster preparations should be sufficient to last 72 hours; however, with analysis of disaster response post-Hurricane Katrina (2005; Gulf Coast USA), it is now established that seven days is a more accurate time frame for the resumption of essential resources.[15] Even though VAD patients will have back-up devices and batteries should hospital power systems fail, the power that the back-up equipment provides may not be sufficient to last the duration of a power outage in the event of a catastrophe. Battery life depends on the model of VAD, how much power it draws, and whether the VAD is providing assistance to one or both ventricles. A fully charged battery can last as little as 40 minutes, in the case of Thoratec paracorporeal assist device (PVAD; Thoratec Corporation; Pleasanton, California USA), and as long as four to six hours, as in the case of HeartMate II left ventricular assist devices (LVADs; Thoratec Corporation; Pleasanton, California USA).[16]

Due to the direct relationship of VAD patient survival and electrical power, the ICS should utilize a proactive triage strategy with this patient population.[11] Clinicians and experts involved in the evacuation efforts of Hurricane Katrina advise that resource-intensive patients be preemptively evacuated or triaged for earliest evacuation due to experiences of delaying evacuation of these patients, and as a result, having to conduct these efforts in harsher conditions.[17] Depending on the type of disaster and if it provides an adequate forewarning, resource-intensive patients should be preemptively evacuated to a facility outside of the disaster zone. This strategy is conducted for the purpose of preventing high-risk and high-acuity patients from being stranded without water or power, avoids evacuating these patients in worse conditions during or after the disaster, and allows for better allocation of staff and resources during or after the disaster.[18] Preemptive evacuation has been successfully utilized in a variety of recent events, such as California (USA) wild fires in 2007, river flooding in North Dakota (USA) in 2009, Tropical Storm Irene in 2011 (East Coast USA), and Hurricane Sandy in 2012 (New York/New Jersey USA).[17,19]

If at any time the electoral power supply of the facility is threatened, or the facility is relying on back-up generators for electrical power, the ICS should initiate the process of evacuating any patients on an Advanced Life Support with no or limited battery life, which includes the VAD population.[17] The evacuation of this patient population should continue in these circumstances even if the rest of the hospital is functioning in as a "shelter-in-place." Hospitals to which patients will be evacuated to should be pre-determined by the ICS. These hospitals should already exist in a mutual aid agreement as per NIMS standards.[14] The ICS should also have plans with EMS and the local government for transportation needs. The ICS will notify nursing and department supervisors of evacuation decision, plans, and approved means of transportation.

Evacuation Triage

In evacuation scenarios, the order of patient evacuation is often debated and has varied amongst different events. Some triage the most stable patients likely to survive transport to be evacuated first and those complex, least likely to survive transport to be moved last.[20] This method is thought to allow the most effort to be spent on those likely to thrive and is based on utilitarian principles. It is suggested that this is an appropriate scenario for an immediate threat situation, such as a fire or explosion.[19] An example of the use of this strategy was a California hospital that feared building collapse following an earthquake and evacuated ambulatory patients first in order to maximize the number of lives saved.[21] It is more common in a less "acute" situation, such as flooding, superstorm, or hurricane events, to prioritize those in the most critical, life-threatening condition to be evacuated first to improve their chance of survival; this would also minimize difficulties associated with evacuation later during the disaster.[17,19,22,23] Transportation and prioritization strategies should be well-defined prior to the actual event and staff should be familiar with these plans.[19]

Due to their dependency on electrical power, VAD patients should be among the first group of patients to be evacuated from the hospital. A VAD is an Advanced Life Support, so these patients are already considered in critical status. They should not be triaged into a later group to risk being exposed to an electrical power shortage or other hazardous conditions. Patients who have an implanted Thoratec DDC or TLC-II (Thoratec Corporation; Pleasanton, California USA) should be the highest priority. This is due to their low battery power reserve. If a patient is on the DDC, they should be transitioned to a TLC-II if at all possible as the DDC has a battery life of less than 40 minutes. Furthermore, the DDC is a large device, weighing 231 kg, and would be extremely difficult to safely evacuate in a timely manner. There are a few conditions in which such patient may not be successfully transitioned to a TLC-II; these include intra-aortic thrombus and cardiac output requiring high pressures that are unable to be maintained by the TLC-II. However, it may be necessary to attempt this transition in order to evacuate the patient. Should this occur, the patient should be maintained on the TLC-II for as

https://doi.org/10.1017/S1049023X17000176 Published online by Cambridge University Press

short of a time as possible. All efforts should be made for the receiving facility to be ready to accept and manage these patients appropriately. Priority facility characteristics include proximity to minimize travel time and equipment (ie, patients operated with a DDC will preferably be transferred to a facility that is equipped with a DDC and the knowledge to manage the patient).

Patients should then be further triaged for evacuation based on health status and remaining battery power. Triage should be conducted by two physicians or two available health care providers.[24] Triage group should be assigned via a numerical designation written on the patient's evacuation tag.

Patient: Staff Evacuation Criteria

While in the hospital, VAD patients require the care of specially trained health care providers who understand how the devices work and the medical implications of different alarms. In a disaster event, there may not be enough VAD-trained providers to accompany each individual patient during evacuation. The telemetry floor of this hospital typically has eight to 11 VAD patients and four registered nurses per shift. There will likely not be enough VAD-trained nurses to accompany each VAD patient during transport. Therefore, patients must be triaged to determine which need to be accompanied by a health care provider and what level of provider. This criterion for triaging patients was based on pre-existing, in-hospital transport protocols.[25]

Transportation Resources

As previously discussed, the ICS will determine evacuation timing and methods based on pre-planning. However, adjustments to these plans may need to be made based on the number of patients, staff, and patient acuity. Nurse supervisors will need to communicate the number of VAD patients needing to be evacuated, the number of trained and untrained staff needed to transport the patients based on the Patient:Staff ratio criteria, and the acuity of the VAD patients. The acuity of VAD patients should be communicated to ICS to confirm that the destination sites are able to accommodate the patients' needs. Communication between ICS and nurse supervisors should be two-way, as the ICS should provide the departments with individualized plans, staffing guides, and contingency and/or crisis care instructions.[26]

Items to Evacuate with Each Patient

Due to the chaos that can accompany a disaster and evacuation event, it is important to have a list to guide staff on what items and supplies a patient needs to be evacuated with. The list includes medical records, VAD supplies, medications that the patient may require during transport (or after transport, depending on the receiving facility), and belongings. If possible, the list of items and supplies should be recorded on the evacuation list for easy tracking and documentation purposes.

Evacuation Tag and List (Figure 2, Figure 3, and Figure 4)

For the purpose of clear communication, patients will have an evacuation tag. The tag will state pertinent information, such as the patient's name, unique identifiers, and evacuation triage group. The tag will be used for rapid reference and for patient identification and evacuation organization. The tag may also be used for communication between health care providers and include important VAD-specific orders, such as anticoagulation goals and VAD pump parameters.

Patient name:
MRN:
DOB:
Evacuation group:
Supplies and medications:

Essential VAD orders/parameters:

Davis © 2017 Prehospital and Disaster Medicine

Figure 2. Evacuation Tag.
Abbreviation: VAD, ventricular assist device.

Patient:
MRN:
DOB:
Time/date left facility:
Intended facility:
Chart/medical records sent: Yes No
Medications sent:
1.
2.
3.
Equipment sent:
1.
2.
3.
Valuables sent:
1.
2.
3.
Staff member(s) transported with patient:
Family/emergency contact notified of transfer: Yes No
Family/emergency contact information
Physician/healthcare provider notified of transfer: Yes No
Physician/healthcare provider contact information

Davis © 2017 Prehospital and Disaster Medicine

Figure 3. Patient Evacuation List.

Staff member:
Patient transporting:
Transportation method:
Transportation service name:
Transportation vehicle identification number:
Intended destination:
Contact information:

Davis © 2017 Prehospital and Disaster Medicine

Figure 4. Staff Member Evacuation List.

Maintain a thorough list of patients and staff members being evacuated from the hospital. King et al found that health care providers benefited from readily available evacuation preparing checklists and tracking system.[27] This should be done to identify the whereabouts of the patients and staff members and to ensure their safety. Furthermore, these lists may be used to provide family members with accurate information regarding patient location and health information.[19] The list should include patient and staff information, items that are being transported with the patient, transportation service/vehicle identification, and information about the receiving facility. Forms should be simple to fill out to minimize the time needed for staff to complete them.[20] While electronic systems may be more efficient, these systems may not be available during a disaster and therefore the staff should be prepared with paper forms.[27] The list should be copied and provided to the ICS and nursing supervisors, and should be kept safely in a folder or envelope to ensure patient privacy.

Failure to Evacuate

If evacuation attempts are unsuccessful or unable to be safely conducted, staff should continue care of VAD patients within the

https://doi.org/10.1017/S1049023X17000176 Published online by Cambridge University Press

crisis standard of care. Evacuation attempts may fail due to hazardous weather conditions, violence and terror threats, and lack of adequate transportation vehicles. In the event of evacuation failure, care will default to "shelter-in-place" stratagem. If the facility no longer has a sustainable electrical power source, a physician, nurse practitioner, or physician's assistant should transition care to palliative measures.[28,29]

Outpatient VADs Seeking Assistance

Outpatients with VADs may also encounter a loss of electrical power or other resources during a disaster. On average, this health system's artificial heart program supports the care of 70 VAD patients. The surge of these patients may overwhelm the evacuation efforts. Redirection of these individuals to other facilities not operating in the disaster zone allows this facility to better meet the demand for resources for its current population, and may reduce the rate of morbidity and mortality for patients already admitted.[11] Lists and directions to these facilities should be pre-determined and provided to the individual in a personal disaster preparedness plan. Should an individual with a VAD report to this facility during a disaster, they should not be turned away but admitted and incorporated into the facility's care and evacuation process.

Ethical Considerations

During a disaster scenario, practitioners may be faced with a variety of ethical dilemmas stemming from factors such as inadequate resources and health care provider shortage. While the standard of care may change in these situations, health care providers are still obligated to practice ethically. As the IOM states, "When crisis standards of care prevail, as when ordinary standards are in effect, health care practitioners must adhere to ethical norms. Conditions of overwhelming scarcity limit autonomous choices for both patients and practitioners regarding the allocation of scarce health care resources, but do not permit actions that violate ethical norms."[24] Ethical norms are defined as practicing with fairness, a duty to care, a duty to steward resources, transparency, consistency, proportionality, and accountability.[24] It is possible that there may come a time that resources are at seriously low levels. In these circumstances, practitioners are ethically justified to allocate remaining resources to "sustain life and well-being to the greatest extent possible."[24] This may translate to directing resources to those patients who are most likely to benefit; however, it does not justify acting without accountability or ignoring professional norms. In order to attenuate the potential ethical dilemmas that practitioners may face, possible difficult decisions were included in the protocol.

Discussion

The VAD evacuation protocol was developed and refined based on expert review, tabletop discussion, and survey. Overall survey responses were positive towards the protocol. Variation in responses regarding ease of execution in a disaster can be attributed to fear and the overwhelming nature of practicing health care in a disaster event.[30] The other category that had a varied response was whether the protocol was congruent to crisis standards of care. This may be attributed to respondents not being aware of what consists of crisis standards of care, as many had questions about this during the tabletop discussion. Regarding concerns from the tabletop discussion that the hospital will not have staff to manage the protocol and evacuation, as in all disaster events, resources including staff will need to be apportioned. This protocol serves as a framework for the allocation of health care professionals. A scenario may develop where staff may need to be more strictly allocated, just as one may present where less hospital staff may be needed to transport patients if there are more available medevac nurses or paramedics.

Limitations

Limitations include a small sample size and specificity to the health system in which it was developed. Many other health systems that care for patients with VADs do not have VAD engineers on their staff. Staff nurses and VAD coordinators often fill the role and services that the VAD engineers provide. Patient feedback was also not used and could have helped to promote transparency, autonomy, and community engagement.

Both this protocol and its corresponding method of development can be adapted for different health systems. Other facilities can use the method of consensus to create protocols that suit their and their patients' specific needs. Health care providers may not be fully educated and prepared for all of the circumstances that a disaster situation may cause. The dissemination, sharing, and use of protocols may help to bridge this gap, alleviate the stress caused by the disaster, guide decision making, and ultimately provide better, safer outcomes. This protocol is evidence that it is feasible to develop evacuation and disaster management protocols in order to enhance a facility's disaster preparedness.

Conclusion

Health care providers may not be fully educated and prepared for all of the circumstances that a disaster situation may cause. The use of protocols may help to bridge this gap, alleviate the stress caused by the disaster, help to guide decision making, and ultimately provide better, safer outcomes. This protocol was created using recent guidelines and literature in hopes to improve the care of VAD patients and health care providers during a disaster.

Supplementary Material

To view supplementary material for this article, please visit https://doi.org/10.1017/S1049023X17000176

References

1. Childers AK, Mayorga ME, Taaffe KM. Prioritization of strategies for patient evacuations. *Health Care Manag Sci*. 2014;17(1):77-87.
2. Abir M, Jan S, Jubelt L, Merchant RM, Lurie N. The impact of a large-scale power outage on hemodialysis center operations. *Prehosp Disaster Med*. 2013;28(6):543-546.
3. Downey EL, Andress K, Schultz CH. External factors impacting hospital evacuations caused by Hurricane Rita: the role of situational awareness. *Prehosp Disaster Med*. 2013;28(3):264-271.
4. Teperman S. Hurricane Sandy and the greater New York health care system. *J Trauma Acute Care Surg*. 2013;74(6):1401-1410.
5. Johnstone M, Turale S. Nurses' experiences of ethical preparedness for public health emergencies and health care disasters: a systematic review of qualitative evidence. *Nurs Health Sci*. 2014;16(1):67-77.
6. Ranse J, Hutton A, Jeeawody B, Wilson R. What are the research needs for the field of disaster nursing? An international Delphi study. *Prehosp Disaster Med*. 2014; 29(5):1-7.
7. Toner E, Waldhorn R, Franco C, et al. *Hospitals Rising to the Challenge: The First Five Years of the US Hospital Preparedness Program and Priorities Going Forward*. Baltimore, Maryland USA: Center for Biosecurity of UPMC; 2009.
8. Daftary RK, Cruz AT, Reaves EJ, et al. Making disaster care count: consensus formulation of measures of effectiveness for natural disaster acute phase medical response. *Prehosp Disaster Med*. 2014;29(5):1-7.
9. Hammad KS, Arbon P, Gebbie K, Hutton A. Nursing in the emergency department (ED) during a disaster: a review of the current literature. *Australas Emerg Nurs J*. 2013;15(4):235-244.

10. Christian MD, Sprung CL, King MA, et al. Triage: care of the critically ill and injured during pandemics and disasters: CHEST consensus statement. *Chest*. 2014;146(4 Suppl): e61S-e74S.
11. Institute of Medicine. *Crisis Standards of Care: A Systems Framework for Catastrophic Disaster Response*. Washington, DC USA: The National Academies Press; 2012.
12. Klein KR, Pepe PE, Burkle FM, Nagel NE, Swienton RE. Evolving need for alternative triage management in public health emergencies: a Hurricane Katrina case study. *Disaster Med Public Health Prep*. 2008;2(Suppl 1):S40-S44.
13. California Emergency Medical Services Authority (EMSA). Disaster medical services division- Hospital Incident Command System (HICS). 2007. http://www.emsa.ca.gov/ disaster_medical_services_division_hospital_incident_command_system. Accessed August 8, 2015.
14. Federal Emergency Management Agency (FEMA). National Incident Management System (NIMS). 2011. https://www.fema.gov/national-incident-management-system. Accessed August 8, 2015.
15. Centers for Medicare & Medicaid Services (CMS). Survey and certification: emergency preparedness for every emergency. 2013. http://www.cms.gov/Medicare/Provider-Enrollment-and-certification/SurveyCertEmergPrep/Downloads/SandC_EP Checklist_Provider.pdf. Accessed June 15, 2015.
16. Thoratec Corporation. Duel drive console instructions for use. http://www.thoratec.com/_assets/download-tracker/14025/14025_IFU-VAD-Dual-Drive-Console_revL.pdf. Accessed June 9, 2015.
17. Zane R, Biddinger P, Hassol A, Rich T, Gerber J, DeAngelis J. Hospital evacuation decision guide. (Prepared under Contract No. 290-20-0600-011.) AHRQ Publication No. 10-0009. Rockville, Maryland USA: Agency for Healthcare Research and Quality; 2010.
18. US Department of Health & Human Services, Agency for Healthcare Research and Quality. 2011. Chapter 3. Pre-event evacuation decision guide. http://archive.ahrq.gov/prep/hospevacguide/hospevac3.htm. Accessed June 15, 2014.
19. Espiritu M, Patil U, Cruz H, et al. Evacuation of a neonatal intensive care unit in a disaster: lessons from Hurricane Sandy. *Pediatrics*. 2014;134(6):e1662-e1669.
20. Femino M, Young S, Smith V. Hospital-based emergency preparedness: evacuation of the neonatal intensive care unit- the smallest and most vulnerable population. *Pediatr Emerg Care*. 2013;29(1):107-113.
21. Schultz CH, Koenig KL, Lewis RJ. Implications of hospital evacuation after the Northridge, California earthquake. *N Engl J Med*. 2003;348(14): 1349-1355.
22. Cocanour CS, Allen SJ, Mazabob J, et al. Lessons learned from the evacuation of an urban teaching hospital. *Arch Surg*. 2002;137(10):1141-1145.
23. Sexton KH, Alperin LM, Stobo JD. Lessons from Hurricane Rita: the University of Texas Medical Branch Hospital's evacuation. *Acad Med*. 2007;82(8):792-796.
24. Institute of Medicine (IOM). *Guidelines for Establishing Crisis Standards of Care for Use in Disaster Situations: A Letter Report*. Washington, DC USA: National Academies Press; 2009.
25. University of Pittsburgh Medical Center (UPMC). Decision algorithm: who should transport the VAD patient? 2011. http://www.upmc.com/. Accessed June 15, 2014.
26. Hick JL, Koenig KL, Barbisch D, Bey TA. Surge capacity concepts for health care facilities: the CO-S-TR model for initial incident assessment. *Disaster Med Public Health Prep*. 2008;2(Suppl.1):S51-S57.
27. King MA, Dorfman MV, Einav S, Niven AS, Kissoon N, Grissom CK. Evacuation of intensive care units during disaster: learning from the Hurricane Sandy experience. *Disaster Med Public Health Prep*. 2016;10(1):20-27.
28. Eschun GM, Jacobsohn E, Roberts D, Sneiderman. Ethical and practical considerations of withdrawal of treatment in the intensive care unit. *Can J Anaesth*. 1999;45(5): 497-504.
29. Society of Critical Care Medicine Ethics Committee. Attitudes of critical care medicine professionals concerning distribution of intensive care resources. *Crit Care Med*. 1994;22:358-362.
30. Baack S, Alfred D. Nurses' preparedness and perceived competence in managing disasters. *J Nurs Scholarsh*. 2013;45(3):281-287.