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Article

Culture of Safety and Preparedness: Benefits of Applying a Daily Mitigation Mindset in the Hospital Setting

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Abstract: Aim: Utilizing the subjective experience of nurse executives who have supervised nurses during a major disaster in a hospital setting, this study aims to describe the subjective experience of nurse executives (NE) who have supervised nurses' response to major disaster. This paper will focus on strategies to support nursing response to disaster, specifically to strengthen resiliency and the ability to maintain function despite the shock of disaster, including those caused by climate changes. Methods: Semi-structured interviews were conducted with 11 hospital-based nurse executives who supervised nurses during some of the worst natural and human-made disasters in different regions of the United States. A phenomenological approach was used to analyze and describe emerging themes from qualitative data. Results: Three Nurse Executives demonstrated theme saturation for mitigation steps to augment traditional disaster readiness activities: 1.) Assessment of Human Infrastructure: Daily Skills Needed During Disaster Response, 2.) Identification and Study of Failure Points & Metrics, 3.) Strengthening Human Infrastructure: Rectifying Deficiencies), and 4.) Monitoring Metrics & Making Corrections During Conventional Periods. Conclusion: Mitigation steps may improve outcomes in hospital function during conventional times; therefore, may improve resiliency and the ability to maintain functions during major disasters, including climate change.

Keywords: risk evaluation and mitigation; nursing; natural disasters; climate; disaster nursing; disaster management

1. Introduction

As the largest component of a hospital workforce (US Bureau of Labor Statistics, 2019), nurses are the first line of defense and best positioned to maintain function and safety in the face of a disaster event. Nurses represent the hospital human infrastructure, a valuable defense against the health impacts of the worst disasters.

1.1. Climate Change and Weather Events

Changes in climate affect the frequency of severe weather events and can result in threats to human health (U.S. Environmental Protection Agency, 2023; Carbajal, 2024). An upward trend in such climate events have occurred within the U.S. and globally between 2018 and 2022 (NCEI, 2023). According to ASPR TRACIE (2022), private sector health leaders and emergency management partners should increase their organizational resiliency by incorporating climate change impacts into their emergency preparedness and response initiatives. Hospital resilience has been described as the ability to maintain function despite sustaining a shock such as earthquake and is achieved when many different infrastructure contexts (e.g., learning from previous disasters, managing the availability of staff, daily communication practices) are strengthened (McDaniels et al., 2008).

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1.2. Emergency Preparedness in the Hospital Setting

Disasters caused by weather events commonly trigger the responses seen with other disasters such as violence and infectious disease outbreaks. Surge, evacuation and shelter in place are the cornerstone of an all-hazards approach to disaster response. A hazard vulnerability assessment guides mitigation efforts to strengthen the physical infrastructure of a hospital to withstand expected threats.

The US Department of Homeland Security (2018) defines mitigation as actions that "reduce the loss of life and property by lessening the impact of future disasters." (p.5) Disaster preparation for hospital-based engineers and emergency preparedness planners focuses on mitigation, the completion of a hazards vulnerability assessment and actions to strengthen and test the physical infrastructure of the hospital.

1.3. Disaster Training for Nurses

Disaster-related education for the pre-licensure nurse trainee is required by the American Association of Colleges of Nursing for doctoral, master's and baccalaureate nursing education (American Association of Colleges of Nursing, 2021; Langan et al., 2017). Education for the post licensure nurse is provided by their employer and primarily driven by the requirements of Medicare & Medicaid Services and accreditation bodies such as The Joint Commission (TJC) (Centers for Medicare & Medicaid Services, 2021; The Joint Commission, 2024). CMS and TJC emergency preparedness standards require hospitals to conduct two testing exercises annually based on their vulnerability assessment and establish a process for all staff to participate in the testing exercises over a period of time. Disaster competencies included amongst general nursing competencies are validated on hire and annually with large numbers of nurses moving through a range of skills stations (Levine. & Johnson, 2014). Levine and Johnson (2014) describe learning modules as lacking interaction and a higher level of decision making that is often needed in emergency situations.

Nonetheless, little is known about how hospital-based nurses in the United States perceive the disaster training they receive or feel about their readiness for disaster (Shipman et al., 2016). Instead, authors of several extant surveys describe small sample sizes, low population representation, and narrow geographic representativeness (e.g., rural), limiting the generalizability of their findings (Baack & Alfred, 2013; Hodge et al., 2017; Rose & Larrimore, 2002; VanDevanter et al., 2017). Surveyed nurses reported the lack of real-life disaster experience as the reason for lacking confidence in their abilities to respond (Hodge et al., 2017; Pincha Baduge et al., 2018; Shipman et al., 2016; VanDevanter et al., 2017).

1.4. Novel Approaches to Enhance Traditional Disaster Preparedness and Response

The complexity of recent disasters may suggest novel approaches to enhance traditional disaster preparedness activities. Despite participating in emergency planning activities to prepare for surge response, hospitals described being unprepared as they faced significant challenges with staffing, supply chains, clinical space, and communication during the COVID-19 pandemic (GAO, 2022). Hospitals resorted to a range of creative strategies to expand their capacity to manage patients and staff during the pandemic (Grimm, 2020). TJC considered questions and issues happening in real time from their accredited and critical access hospitals regarding crisis standards of care (Hick et al., 2022). They observed that few health care systems had planned for the process of implementing crisis care strategies but instead focused on protocols for triaging specific interventions (e.g., ventilators). The experiences from the field drove new requirements, the elimination of redundancy and the development of a concise and meaningful framework to support vital processes. Based on lessons learned from Hurricanes Harvey, Irma and Maria, the National Academies of Sciences, Engineering and Medicine (2020) suggest augmenting the traditional focus of providing relief during a disaster with preemptive tactics to understand causes of unmet demand (e.g., identifying bottlenecks, gaps and broken links in local supply chains) so stakeholders know how a hurricane can disrupt their supply chain and what they need to do to restore normal operations as soon as possible.

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While mitigation is most often used as a term to strengthen the physical infrastructure of a hospital, frontline nurses could be considered as human infrastructure and the actions required of nurses during disaster response are often the same activities performed every day, but with increased speed, intensity, and volume. Inefficiencies in patient flow are associated with poor patient care outcomes (Melton et al., 2016; Walker et al., 2016) and left unaddressed, chronic inefficiencies (e.g., delays in care, supply chain issues, inadequate or lack of resources, etc.) are likely to worsen under the pressure of disaster (Melnyk et al., 2018).

Lesson learned from all disasters, regardless of cause, serve to inform response to disasters caused by climate. Novel approaches to enhance traditional disaster preparedness and response can only strengthen nurses, the human infrastructure within the hospital setting. The aim of this paper is to describe the subjective experience of nurse executives (NE) who have supervised nurses' response to major disaster. This paper will focus on strategies to support nursing response to disaster, specifically to strengthen resiliency and the ability to maintain function despite the shock of disaster, including those caused by climate changes.

This work represents efforts by Veterans Emergency Management Evaluation Center (VEMEC) to support a 2014 Disaster Nursing Call to Action (Langan et al., 2019; Veenema, 2016a; Veenema et al., 2016b; Veenema et al., 2017). The Department of Veterans Affairs is the largest employer of nursing personnel in the United States (US) and has a vested interest in identifying organizational strategies to support nurses' response to disaster events.

2. Methods

The research team consists of five researchers, all with disaster experience. The study was reviewed and approved by [Name of institution IRB and number]. The participants received a research information sheet covering all points of consent prior to the interview.

2.1. Study Design

A phenomenological approach was used to describe the lived experience of NEs who supervised nurses during a major disaster in the hospital setting. A phenomenological research design provides a framework leading to the understanding of the individual experiences and how a phenomenon affects person during an event (Streubert, 2011). The purpose was to examine actions by the nursing leader during an emergency event to extrapolate best practices along with lessons learned. Major disasters caused by a range of disaster types and geographical locations were considered based on news reports, public after-action reports, and key informants. Contact information was obtained through the hospital website or telephone directory. Thirty NEs who had experienced disasters caused by fire (3), infectious disease (13), violence (7) and weather (7), received an email invitation, an IRB approved research information sheet, and a follow-up telephone call. Of those invited, 17 did not respond, 2 refused without a stated reason and 2 provided 2 referrals. The 11 who agreed to participate had experience supervising events caused by infectious disease (4), violence (5), and weather (4). The events occurred between 2014 and 2020 and the length of time between disaster event and interview date ranged from 6 months to 3.5 years. Table 1 provides a summary of participant and disaster characteristics.

Table 1. NE Participant/Disaster Characteristics.

Nurse Executive	Disaster	Impact
NE1	Weather	Tornado destroyed hospital, required emergent evacuation
NE2	Weather	Hurricane caused flooding and generator failure, required emergent evacuation
NE3	Violence	Mass casualty incident, 212 critical surge victims, 75% dead on arrival

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NE4	Violence	Mass casualty incident, 50 emergent surgical cases
NE5	Violence	Active shooter on multiple nursing units, 2 fatalities, multiple injured
NE6	Violence	Onsite active shooter in perioperative department, 2 fatalities, multiple injured
NE7	Weather	Hurricane caused flooding and destruction of hospital infrastructure, extended shelter in place followed by evacuation
NE8	Infectious Disease	Influenza season, surge required alternate care sites
NE9	Weather Violence Infectious Disease	Hurricane, shelter in place Bombing, critical care surge victims Mass casualty incident, critical care surge victims Ebola, presented to emergency department
NE10	Infectious Disease	COVID-19, surge
NE11	Infectious Disease	COVID-19, alternate care site

The interviews were conducted by telephone after verbal agreement from private and secure offices and lasted approximately 30-60 minutes. Interviews were audio recorded and professionally transcribed. All transcripts had a quality assurance check against the voice recording.

The interview guide included four questions: (1) Describe your observations of the range of roles and responsibilities assumed by the nurses you supervised, (2) In recalling the knowledge, skills and abilities required of nurses during the disaster you supervised, can you describe what you think best prepares nurses? and (3) Based on your experience and observations, can you suggest organizational strategies for supporting nursing response during disaster in the hospital setting?

All research team members participated in coding. Each member was assigned as the lead coder for a shared number of interviews. Using Excel, the lead tagged quotation chunks with emerging codes and grouped them under main theme headings as they emerged. The lead presented a summary in memo format to the team for group discussion and reconciliation of any disagreements. As interviews were reviewed, two designated team members managed a master Excel file and methodology tracking document. Codes and theme categories were eventually collapsed during group discussions. If needed, a short follow-up audio-recorded telephone call with the participant took place to clarify any questions.

3. Results

Researchers reviewed all raw interview data codes and considered a subset representative of applied mitigation. The subset is listed below, and Table 2 illustrates saturation across all interviews.

Table 2. Theme Saturation.

Nurse Executive	Disaster	1	2	3	4
NE1	Weather	*			
NE2	Weather				
NE3	Violence	*	*	*	*
NE4	Violence	*			
NE5	Violence		*	*	
NE6	Violence	*	*	*	*
NE7	Weather				
NE8	Infectious Disease				

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NE9	Violence, Weather, Infectious Disease	*	*	*	*
NE10	Infectious Disease	*			
NE11	Infectious Disease	*			

1: Assess Human Infrastructure: Daily Skills Needed During Disaster Response. 2: Identify and Study Failure Points & Metrics. 3: Strengthen Human Infrastructure: Rectify Deficiencies. 4: Monitor Metrics & Make Corrections During Conventional Periods.

3.1. Mitigation Steps to Establish Readiness

1. Assessment of Human Infrastructure: Daily Skills Needed During Disaster Response
2. Identification and Study of Failure Points & Metrics
3. Strengthening Human Infrastructure: Rectifying Deficiencies
4. Monitoring Metrics & Making Corrections During Conventional Periods

Three of the NE experiences demonstrated theme saturation in these categories, and accordingly, this study focuses on those experiences to describe these applied mitigation steps that respondents identified as necessary to establish readiness. The experience of NE3 serves as a clear illustration of ***Mitigation Steps to Establish Readiness***. NE3 looked back on a quality assurance project to address the failure point of holding patients in the emergency department and retrospectively realized the project served as a source of mitigation. The following are excerpts from the experience and demonstrate the concept of how everyday hospital strategies can serve as mitigation. The scale of incoming surge from a mass casualty incident (MCI) was compared to a plane crashing in the middle of a field. Victims arrived suddenly and in a disorganized fashion; few carried identification.

"*They arrived by POV* [privately owned vehicle], *people carrying them on their shoulder, people carrying them in their arms, police cars, Uber drivers... they were literally loading people into the back of pickup trucks, as many as they could carry that were wounded, and they were bringing them into our organization*".

Onsite doctors and nurses from every department worked in teams, as if they were in a "war" or "war zone." They used the lawn of the hospital as an entry point to triage and transport patients to various parts of the hospital. Some patients went directly to the operating room (OR). Depending on the type of injury, unstable patients were taken to various intensive care units (ICUs) where they were intubated and stabilized until OR rooms became available (e.g., head trauma to neuro ICU, chest trauma to surgical ICU, etc.). Stable patients were taken to the post anesthesia care unit (PACU) to be medicated for pain while they waited for their turn to be taken into surgery. To make beds available, nurses in med/surg grouped several patients into one room, discharged those who were eligible, and transferred approximately 50 patients to "sister" hospitals.

"*Within the course of about six hours, we had 212 patients present for treatment. Within about three hours, we had 80 or so of them for surgery*".

3.2. Assess Human Infrastructure: Daily Skills Needed during Disaster Response

A year and a half before the MCI, the entire hospital examined a daily habit of holding admitted patients in the emergency department (ED) for extended periods while they waited for beds on the med/surge nursing units. This NE described a throughput exercise to decrease patients being held in the Emergency Department which ultimately prepared the nursing staff to respond to a mass casualty event.

"We weren't preparing for a mass casualty incident. We were trying to become efficient taking care of 176,000 ER visits and deliver safe effective care. And we had relentlessly focused on that for a good year and a half".

"...when the patients were coming to the floor [during the MCI], they were just doing it at a quicker clip than what we did on a day-to-day basis".

3.3. Identify and Study Failure Points & Metrics

This nurse executive set an expectation that every manager and their units agree to identify and study all delays between hospital admission and discharge to vehicle.

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"We simply defined…our failure points and said holding 80 patients is a failure in our system and then began to follow the string back to where the processes were breaking down in the system. I mean we measured every data point you could measure and just worked on making them better with the individual stakeholders".

3.4. Strengthen Human Infrastructure: Rectify Deficiencies

Each delay was replaced with a more efficient behavior and practiced until holding patients in their ED was no longer a habit. Every nurse understood they were personally accountable and equally culpable for efficiently managing patient volume from the order to admit, to assisting patients into their transport vehicle at discharge, regardless of department.

"And we had relentlessly focused on that for a good year and a half, and so when the patients started coming in at that pace…imagine holding 80 to 110 patients admitted and still seeing 176,000 patients a year. They were doing that every day, day in and day out. And all we did to facilitate was throw the back door of the ED open and teach the inpatient units how to handle the flow".

3.5. Monitor Metrics & Make Corrections during Conventional Periods

The culture changed and the new behaviors became the norm. Nurses throughout the hospital were surprised to realize the impact their work habits had on the management of patient flow within the ED.

"And so of course I had a surge policy. So how I comprehended it was a surge policy - what I would do if we get to this number of patients, we get to this number of patients, we get to that number of patients. But what they're asking--and honestly, I didn't know what that meant until [the MCI event]. Now I understand what that meant. I feel like I'm a good CNO, above average in some ways, and I didn't understand it. I would say that most CNOs don't understand what they're being asked. You're only thinking about--we're thinking about the more tangible things, like, where we put people, you know, where I'm going to overflow to, when it goes layers and layers and layers deeper than that".

"I took a very broken hospital and took a few good leaders, and we changed the culture. And because we did that, a lot of people lived".

4. Discussion

The subjective experiences of nurse executives illustrate the magnitude of disruption when hospitals are impacted by disaster and the depth of strength required to respond. Assessing daily activities, studying failure points, strengthening, and rectifying weaknesses and monitoring during conventional times, serves as a parallel to how emergency managers approach mitigation efforts to strengthen the physical structure of a hospital. Applying a mitigation mindset to nurses as the human infrastructure of the hospital, may enhance traditional disaster content and drills and ultimately help prepare for disasters as the impact of climate changes continues.

A mitigation mindset for nurses fits within existing regulatory requirements. Effective July 2022, The Joint Commission (2021) updated their emergency management standards to include ensuring "that critical components of the program are addressed in the mitigation, preparedness, response, and recovery phases and integrated throughout the organization and within the larger community response network" (p.2). Relatedly, the requirements promulgated by Centers for Medicare & Medicaid Services (2021) require that "The comprehensive risk assessment should include all risks that could disrupt the facility's operations and necessitate emergency response planning to address the risk mitigation."

Using a mitigation mindset to strengthen the human infrastructure within a hospital supports resiliency and the ability to maintain functions during a disaster. Assessing daily activities is consistent with familiar continuous quality improvement methodologies such as Lean Six Sigma (Breslin et al., 2014), Plan-Do-Study-Act cycles (Kresch et al., 2017), and Baldrige Criteria (Foster et al., 2007) but with a specific operational outcome, disaster preparedness. Identifying and studying failure points can happen during conventional times. Some activities might include measuring the speed and accuracy of blood or medication administration or the speed of completing diagnostic

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tests. The availability of life-saving equipment (e.g., personal protective equipment, narcotics, pharmaceutical drugs for intubation, chest tubes, etc.) could also be monitored and tested daily. Clinical practice guidelines (Barr et al., 2013; Tolich et al., 2013) could provide guidance to rectify deficiencies. Ongoing monitoring of metrics during and adjacent to periods such as weekends, influenza season, staffing shortages or security breach events could provide insight into failure points.

Furthermore, creating a culture of preparedness to withstand the worst disaster, as a part of the proposed mitigation framework, is consistent with the recommendations made by a National Academies of Sciences, Engineering and Medicine (2019) committee to "Establish and sustain a system-wide culture that promotes help-seeking behaviors and supports psychological safety" (p.2) and supports the concept of creating a culture of preparedness to mitigate the damaging impacts of occupational and disaster exposure.

The narrative example provided by NE3 is a valuable illustration of NAM's (2020) suggestion to understand the causes of disruption to know how to repair and restore normal operations. Staff identified bottlenecks, gaps, and broken links in their discharge process which gave them the knowledge and skills to manage the flow of surge after a mass casualty event and quickly restore normal operations.

A culture of preparedness or a culture of safety depends on organizational services (e.g., wellness services provide by human resources, employee assistance programs, etc.) which are needed every day and during disaster response. Assessing, strengthening, and testing those services during drills and conventional times create or enhance a safety net capable of responding during and after a disaster. Workplace violence preventions standards (McPhaul et al., 2013) and training resources such as de-escalation training (Spears & McNeely, 2019) serve as examples for guidance to rectify deficiencies (Arnetz, 2022).

5. Limitations

As a small qualitative study, the generalizability of our findings is limited.

6. Conclusions

Nurses are predictably on the frontline of disaster response, especially in the hospital setting. Severe weather events brought about by climate change cause a threat to human health. This paper adds to the body of evidence supporting the augmentation of traditional training to include practical mitigation efforts. While mitigation is a familiar term used to describe strategies to harden the physical infrastructure of a hospital, nurse executives who have supervised nurses' response to major disasters in the hospital setting described strategies which strengthened and protected the human infrastructure within a hospital- the frontline nurses. Mitigation steps may improve outcomes in hospital function during conventional times; therefore, may improve resiliency and the ability to maintain functions during major disasters, including climate change.

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