

Southern California CSU DNP Consortium

California State University, Fullerton
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DISASTER PREPAREDNESS: NEONATAL INTENSIVE CARE UNIT
EVACUATION TRAINING

A DOCTORAL PROJECT

Submitted in Partial Fulfillment of the Requirements

For the degree of

DOCTOR OF NURSING PRACTICE

By

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ABSTRACT

In the last several years, medical centers faced natural disasters that required the emergency evacuation of hospitalized patients, including premature and critically ill neonates. The emergent evacuation of this vulnerable population is reliant on staff and technology for all aspects of care and considered a high-risk activity. In response, The Joint Commission issued specific requirements for emergency management and disaster preparedness, known as Standards of Care for Disaster Preparedness and Response. Hospitals were mandated to have a disaster management program in place that addressed emergency preparedness and planning activities. A quality improvement project was created to improve the processes related to the safe and efficient emergent evacuation of neonates and ensure hospital alignment with The Joint Commission's recommendations for a comprehensive Emergency Operations Plan.

Results of education and training of 33 neonatal nurses on a department-specific emergency response plan, roles and responsibilities during neonatal evacuation, and the use of evacuation equipment indicated increased knowledge (based upon responses to a 10-item knowledge questionnaire, $d = 2.37$) and self-efficacy (based upon responses to a 4-item questionnaire, $d = 1.56$). Also, the task force developed for this project has turned into an appointed, on-going interprofessional, multifacility committee, chaired by the author, whose purpose is to present findings and proposed solutions on NICU disaster

preparedness and emergency management issues to hospital and regional disaster
preparedness administration.

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BACKGROUND

On August 29, 2005, Hurricane Katrina devastated New Orleans with massive flooding and was declared to be the most destructive disaster, natural or man-made, to occur in the history of the United States. Nurses at Memorial Medical Center were challenged to provide care for 16 critically ill neonates in their Level 3 Neonatal Intensive Care Unit (NICU) (Bernard & Mathews, 2008). The hospital became isolated due to widespread flooding, extreme heat temperatures, power outages and limited resources (Barkemeyer, 2006). Attempts to evaluate the neonatal patients were hampered by chaos and disorganization, despite the hospital's formal Hurricane Response Plan, which included disaster-planning drills (Bernard, 2008). Articles describing the disaster response were published shortly afterward, which described in great detail the major challenges and lessons learned by the hospital, receiving hospitals and staff from the post-hurricane evacuation (Ginsberg, 2006; Thompson, 2007).

Seven years later, on October 29, 2012, Hurricane Sandy descended on New York City, causing a coastal surge with massive flooding and power outages throughout the city, again requiring the emergency evacuation of neonatal patients. New York University Langone Medical Center was able to safely evacuate 21 critically ill neonates from the NICU. Their successful emergency response reflects the extensive preparations and Emergency Operation Plan modifications gained from the experience of a planned, controlled, pre-emptive NICU evacuation that was performed nearly one year previously, when Hurricane Irene struck the city on August 28, 2011 (Espiritu et al., 2014). Yet the medical center also encountered many unanticipated challenges that were not identified as part of their evacuation scenario.

It is clear from a retrospective review of the lessons learned from these events (Barkemeyer, 2011; Femino, Young, & Smith, 2013; Orlando, Bernard, & Mathews, 2008; Pfeiffer et al., 2008) that every hospital with a NICU must design, develop, and implement a NICU-specific departmental emergency management plan to address the special needs of their neonatal population as part of the overall disaster preparedness plan (Clancy & Kacica, 2012). The Joint Commission (TJC) Standards of Care for Disaster Preparedness and Response (2015) require all hospitals to have an emergency management program, known as the Emergency Operations Plan or EOP, in place as part of emergency preparedness. Indeed, TJC (2013b) describes Hurricane Sandy as a “major wake-up call,” urging hospitals to apply the learning that emergency preparedness includes “being ready to evacuate occupants prior to or during the disaster” (p. 1). Many times hospitals guidelines fail to address neonatal disaster planning as a component of their EOP. The Joint Commission’s 2015 “Emergency Management” (EM) accreditation requirements call for a comprehensive approach to the planning, preparedness, and testing activities of disaster preparedness, and provide guidance on the requirement for clear definitions of staff roles in disasters, the training for these roles and responsibilities, and sustaining staff competencies over time. TJC (2013a) has emphasized the importance of having a clear evacuation plan, and ensuring that it functions as designed as part of a successful overall evacuation strategy.

Neonates, who are the smallest and most vulnerable of hospital patients, are totally dependent on health care team members to meet all their needs, and thus are also the most challenging to evacuate during an emergency or disaster (Giarratano, Orlando, & Savage, 2008; Phillips, Niedergesaess, Powers & Brandt, 2012). The evacuation of

critically ill neonates dependent on life-sustaining technology requires careful preparation and a NICU emergency response plan based on the most current literature, including recently published neonatal evacuation guidelines and toolkits (Carbine, Cohen, Hopper, Murphy, Phillips, & Powers, 2015; Illinois Emergency Medical Services for Children, 2009; Illinois Emergency Medical Services for Children, 2013; Loma Linda University Children's Hospital, 2013). The Association of Women's Health, Obstetric, and Neonatal Nurses (AWHONN, 2010) has created a core competency set to guide the emergency preparedness and disaster response education and training of perinatal and neonatal nurses. Unless education and training on NICU emergency management is provided upon hire to the hospital and as annual training, NICU nurses may not be clear as to their expected roles and responsibilities in emergency neonatal evacuation.

Problem Statement

Providence Holy Cross Medical Center (PHCMC) is a 377-bed not for profit hospital offering inpatient and outpatient services in Mission Hills, a district within the Los Angeles County in the northeast San Fernando Valley. Demographics for the community include approximately almost 2 million residents in the San Fernando and Santa Clarita Valleys, predominately Latino (53.13%), with White (30.36%), Asian (10.72%), Black (3.43%), and Other (2.34%). The district is considered highly diverse for the city of Los Angeles, with a diversity index of 0.615. The population is predominately young, with a median age of 34 years; the population by age distribution for 0-14 years is 22.51%, for 15-24 years is 15.08%, for 25-44 years is 29.10 %, for 45-64 years is 23.67%, for 65-84 years is 8.22%, and for 85+ years is 1.42% (Los Angeles Times, 2009; Providence Holy Cross Medical Center, 2012).

After a tragic mid-air collision occurred in the Northeast San Fernando Valley in January 1957, local citizens approached the Sisters of the Holy Cross, concerned about the lack of an acute care facility in the community. Hospital ground was broken in 1958, and Holy Cross Medical Center opened its doors in 1961 (Providence Holy Cross Medical Center, 2012; Sisters of the Holy Cross, 2007). The hospital was severely damaged but rebuilt after both the 1971 Sylmar and 1994 Northridge earthquakes. The medical center joined the Sisters of Providence Health Systems in 1996. In late 2012, a new Women's Pavilion opened that included a 12-bed NICU for premature and critically ill neonates, the first NICU for high-risk newborns in the North San Fernando and Santa Clarita Valleys. PHCMC was approved by the California Children's Services as a Special Facility Hospital with a Level III Community NICU in January 2013; since receiving approval, the NICU has maintained an average daily census of 11.5 premature and/or critically ill neonates.

The hospital has a well defined EOP and Incident Command System; there is a basic NICU departmental policy for the evacuation of neonates. Femino et al.'s (2013) study revealed that NICU nurses have little knowledge regarding emergency response planning within their hospitals and within their own units. Research has indicated the need for nursing to be included in emergency planning and education, including the core principles of disaster management, as issues within patient-specific populations can thus be better anticipated, with the identification of solutions that may not have been previously considered (IEMSC, 2009, 2013). An opportunity was identified to provide the NICU nursing staff with department-specific training and education on the hospital's disaster plan response, the NICU evacuation plan, their roles and responsibilities, and

available equipment. The educational curriculum was based on the Emergency Preparedness and Disaster Response: Competency-based Educational Objectives for Perinatal and Neonatal Nurses (AWHONN, 2010), the California Association of Neonatologists' (CAN) Neonatal Disaster Preparedness (Carbine et al., 2015), and the NICU/Nursery Evacuation Exercise Toolkit (IEMSC, 2013). The AWHONN core competency set (2010) has identified measurable learning objectives for neonatal nurses as part of emergency preparedness and disaster response education and training. The CAN toolkit (Carbine et al., 2015) was created using community, evidence-based practice models. Additionally, it provided guidance to NICU leadership in ensuring compliance with TJC's Emergency Management Standards (2015), specifically Elements of Performance EM.02.02.03 Resources and Assets, EM.02.02.07 Staff, and EM.02.02.11 Patients. The IEMSC toolkit (2013) was developed to assist medical centers in the implementation of NICU evacuation guidelines into their EOPs and provide guidance on the planning, conduction, and evaluation of NICU disaster management.

Purpose Statement

The purpose of this doctoral project was to improve the medical center's processes related to the safe and efficient neonatal evacuation via the incorporation of NICU-specific guidelines as part of a comprehensive hospital disaster management plan. The project responded to TJC's (2015) recommendation for a comprehensive hospital EOP, i.e., preparedness and planning of activities before an emergency, and was designed to enhance PHCMC's current EOP.

The following questions were proposed by this quality improvement project:

1. What effect does an educational program based on the AWHONN Emergency Preparedness and Disaster Response: Competency-based Educational Objectives for Perinatal and Neonatal Nurses and the CAN Neonatal Disaster Preparedness Toolkit have in preparing NICU nurses for their roles and responsibilities in emergency infant evacuation?
2. How does an educational program based on the AWHONN Emergency Preparedness and Disaster Response: Competency-based Educational Objectives for Perinatal and Neonatal Nurses and the CAN Neonatal Disaster Preparedness Toolkit impact NICU nurses' knowledge about departmental plans, procedures, and policies for emergency infant evacuation?

Supporting Framework

The primary organizing framework for this project was the Deming Cycle for Learning and Improvement, a continuous quality improvement model, created in 1993 by Dr. W. Edwards Deming, a total quality management expert and statistician (Deming, 1982). The model, commonly known as the Plan-Do-Study-Act (PDSA) Cycle, was Deming's modification of the Shewhart Cycle, created in 1929 by Walter A. Shewhart, who was also a statistician. Moen (2009) stated that Deming described the PDSA Cycle as "a flow diagram for learning, and for the improvement of a product or of a process (p. 8). Figure 1 illustrates the key concepts of the PDSA Cycle.

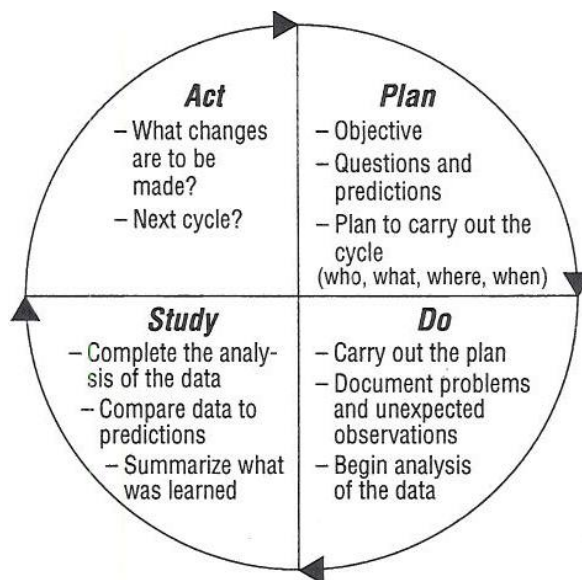


Figure 1. The Deming Cycle, or PDSA Cycle. From “Foundation and History of the PDSA Cycle” by R. Moen, 2009. Reprinted with permission.

The Institute for Healthcare Improvement (2015) has endorsed using the PDSA Cycle as part of the Associates in Process Improvements’ Model for Improvement (Langley, Moen, Nolan, Nolan, Norman, & Provost, 2009) for testing change as action-oriented learning. The IHI (2015) has provided detailed guidelines on the cycle steps shown in Figure 1:

- **Step 1: Plan.** Begin by planning the test or observation, including a data collection plan. State the objective of the test and predict what will happen and why. Develop a plan of action to test the change. Questions to ask include: Who? What? When? Where? Examples of specific questions that were needed for the author’s project included: Who required education? What data were needed to be collected? What metrics were needed? When could the education occur? Where is the evacuation equipment housed?

- Step 2: Do. Try out the test of change on a small scale. Improvements, observations, trends, unexpected problems or effects and their causes are documented.
- Step 3: Study. Time must be allocated for data analysis and outcome measurement. After completing the data analysis, findings are compared to the predictions from the planning step. Learnings are summarized and reflected upon for additional insights.
- Step 4: Act. Improve and refine the proposed change as indicated by learnings and insights. Standardize all improvements made. Determine which modifications or adjustments need to be made, and then implement. Celebrate all improvements and lessons learned. Prepare a plan for the next small-scale test as part of a continuous improvement cycle.

Testing for change on a small scale using the PDSA Cycle will allow for the new knowledge gained from each test, including modifications, to be incorporated into the implementation of the emergency response plan on a larger scale throughout the NICU. Continuous use of the PDSA Cycle will ensure ongoing improvement of the plan.

In addition to the PDSA model, the project incorporated aspects of the Diffusion of Innovations (DOI) Theory to support the implementation of practice changes. The DOI theory is a social science theory developed in 1962 by Everett M. Rodgers, PhD, who was professor and chair of the Department of Communication and Journalism at the University of New Mexico. Rogers (2003) described diffusion as “the process by which an innovation is communicated through certain channels over time among members of a social system” (p. 21), and innovation as “an idea, practice, or object that is perceived as

new by an individual or some other unit of adoption” (p. 26). Rogers’ research studied how innovations are spread, or diffused, and identified the basic patterns of diffusion, various categories of adopters, and factors that influence the decision to adopt an innovation. Rogers (2003) stated that diffusion occurs through a five-step innovation-decision process:

1. Knowledge occurs when an individual (or other decision-making unit) is exposed to an innovation’s existence and gains an understanding how it functions.
2. Persuasion occurs when an individual (or other decision-making unit) forms a favorable or unfavorable attitude towards the innovation.
3. Implementation occurs when an individual (or other decision-making unit) puts the new idea into use.
4. Confirmation occurs when an individual (or other decision-making unit) seeks reinforcement of an innovation-decision already made, but may reverse this process decision if exposed to conflicting messages about the innovation.

The dynamics of innovation diffusion have been used in healthcare to provide improved care by adopting new practices and technologies and assessing organizational readiness for evidence-based practice (Carlson, 2009; Gale & Schaffer, 2009). However, internal organizational timelines and approval processes and procedures are often significant barriers to innovation diffusion. Rogers (2009) stated, “Getting a new idea adopted, even when it has its obvious advantages, is often very difficult” (p. 18). The need for regulatory compliance with TJC’s Emergency Management Standards served as a driver to fast track the approval for education. The DOI theory was utilized to assist the

NICU nursing staff in the acquisition and performance of new behaviors related to emergency infant evacuation. In planning for change with adoption of new policies and procedures, potential barriers and facilitators must be identified and addressed in order for the nurses to find value in the innovation (Gale & Shaffer, 2009). The educational course was developed with strategies to appeal to each of the five different categories of adopters. Rodgers (2013) provided main characteristics of each category:

- Innovators are venturesome, with interest in new ideas.
- Early Adopters are respected and have the highest degree of opinion.
- Early Majority members are deliberate, and are an important link in the diffusion process.
- Late Majority members are skeptical and motivated by peer pressure.
- Laggards are traditional, with a reality that is system-blame.

Project Objectives

Components from the AWHONN Emergency Preparedness and Disaster Core Competency Set for Perinatal and Neonatal Nurses (2010), CAN Neonatal Disaster Preparedness Toolkit (Carbine et al., 2015), and the IEMSC NICU/Nursery Evacuation Exercise Toolkit (2013) were used to provide quality improvement education for the NICU nursing staff, identify weaknesses in the current NICU evacuation policy, and improve the hospital's EOP. The project objectives were:

1. Assess the NICU nurses' knowledge of their roles and responsibilities in neonatal evacuation procedures.

2. Educate the NICU nurses on the existing emergency evacuation protocol, including equipment and supplies, identification verification procedures, and documentation.
3. Evaluate the effectiveness of information adapted from the core competencies and toolkits on increasing the NICU nurses' awareness and knowledge of neonatal evacuation procedures within the overall EOP.
4. Identify possible areas and opportunities for improvement in NICU evacuation communication, resources, and training.

The author's expectation is that with education and training to provide solid clinical knowledge of expected roles, the NICU nurses will be able to provide safe, effective, and efficient neonatal evacuations as part of a departmental-specific policy and the hospital-wide emergency management plan. This project is part of a larger quality improvement program to create a more robust NICU-specific emergency response plan. Future plans include educational modules and training exercises on NICU evacuation procedures, integrated into the overall hospital disaster management program.

REVIEW OF LITERATURE

Search Methods

A careful and thorough review of the literature was completed in the preparation for the development of this quality improvement project. Only original, primary source health care-related reports and articles were considered, and a language restriction was placed that excluded articles not written in English. A systematic review was performed in key electronic bibliographic databases, i.e., Academic Search Premier, CINAHL® Plus, Cochrane, OVID, ProQuest Nursing & Allied Health Science, PubMed/MEDLINE, and PsychInfo. All databases were searched for publications relevant to the topics of neonatal evacuation and disaster management. The search strategy included the use of appropriate keywords, subject headings, and medical subject headings to search the databases, including *disaster*, *emergency readiness*, *equipment and supplies*, *evacuation*, *hospital planning*, *joint commission*, *neonatal intensive care*, *neonatal nursing*, and *nursing*. Further search terms included *disaster education*, *disaster preparedness*, *emergency preparedness*, and *vulnerable populations*. All references were screened, and abstracts reviewed, with retrieval of full text articles as appropriate.

The author had initially focused on using peer-reviewed journal articles to be selected for review. However, due to the paucity of quantitative and qualitative research articles published on the subject of interest, the literature search was expanded to include non-research references, i.e., case reports, position papers, educational literature, clinical and anecdotal descriptions. The reference lists of all retrieved documents were cross-matched for maximal retrieval of relevant literature. Additionally, the author performed a manual “hand” search of reference lists for the identification of additional relevant

articles overlooked by electronic searching. A key researcher was identified and contacted about additional information, i.e., an unpublished interview and report on quality improvement.

The results of the review of literature identified that knowledge about disaster evacuation is primarily focused on adult populations, although there is an emerging awareness on the importance of neonatal disaster preparedness related to Hurricanes Katrina and Sandy. There were no opposing viewpoints on the importance of neonatal disaster preparedness. The results provided the author with the opportunity to present data supporting the need for the educational project as a means to mitigate an identified gap in nursing knowledge on the most current neonatal evacuation recommendations.

Information gathered from the literature was reviewed, interpreted, and the results synthesized. Literature findings from the guidelines, resources, and quantitative and qualitative studies were congruent with their overall message. A Table of Evidence (see Appendix D) is provided for a detailed list of key research articles identified by the author. All were favorable and substantiated the need for nursing education and training on neonatal evacuation. Three methodological themes related to NICU neonatal evacuation publications emerged: (a) evidence-based evacuation guides and resources, (b) disaster preparedness and evacuation quantitative studies, and (c) disaster preparedness and evacuation qualitative studies.

Evidence-based Evacuation Guidelines and Resources

The lessons learned from the recent U.S. natural disasters have led to a renewed emphasis on the rectification of deficient disaster preparedness planning in hospitals. Recently published guidelines and toolkits provided detailed information on best-

evidence practice models for neonatal evacuation, with a focus on meeting the unique needs of neonatal patients related to their critical illnesses, total dependence on healthcare providers, and advance technology for survival (Carbine et al., 2015; IEMSC, 2009, 2013; LLUCH, 2013). The impact that disasters have on the ability of a NICU to provide care has placed even more importance on NICU professionals taking the lead in planning and preparing for evacuations (IEMSC, 2009; Jorgenson, 2010; TJC, 2013a). As seen in Appendix D, Table 1, guidance on the minimum standards for the development, implementation, and evaluation of evidence-based, competency-based emergency preparedness and disaster response education and training of neonatal nursing staff is now available.

Disaster Preparedness and Evacuation Quantitative Studies

Few truly quantitative studies had been published on neonatal disaster preparedness and evacuation, as the majority of research has focused on the response of nurses to biological terrorism in adult populations. There exist multiple barriers that impact nurses' ability and willingness to respond during major disasters, and the evidence urges healthcare institutions to explore and mitigate those potential barriers (Adams & Berry, 2012). One commonality identified by the studies was the importance disaster preparedness training has played affecting nurses' willingness to report to work and their perceived levels of disaster preparedness, confidence, and adaptability (Adams & Berry, 2012; Baack & Alfred, 2013; Clancy & Kacica, 2012; Femino et al., 2013). A positive correlation was identified between: (a) awareness of emergency preparedness planning, (b) utilization of toolkit elements, (c) provision of educational opportunities (i.e., training and drills), and (d) whether an adequate EOP existed in the hospital to address issues on

staffing, equipment, and protocols for infant and child patient populations affected by disasters. Findings by Baack and Alfred (2013) indicated nurses' had low perceived preparedness on readiness, ability, and commitment to respond and act during a disaster. Recommended actions to prepare nursing to respond to disaster situations are noted in Appendix D, Table 2, and included comprehensive education and training with review of disaster preparedness content and application of knowledge, which showed an increase in perceived preparedness and actual abilities in preparedness. Additionally, the use of an evacuation exercise, such as that described by Femino et al. (2013), was proven to be useful as part of an emergency evacuation response plan and educational course to train staff caring for vulnerable neonates.

Disaster Preparedness and Evacuation Qualitative Studies

Teamwork was identified as the main theme throughout the qualitative disaster preparedness and evacuation literature reviewed (see Appendix D, Table 3). Neonatal nurses working during time of disasters are required to work as a team, with the common goal of efficient and safe evacuation of NICU neonates. Teamwork was cited as essential, but has not been facilitated by current staffing and healthcare delivery structures to create strong work teams (Simmons & Sherwood, 2010). The development of strong, functional NICU teams that perform high-risk team-critical activities was identified as crucial, with the clear understanding of roles and responsibilities critical to ensure positive outcomes during disaster management. Simmons and Sherwood (2010) described NICU nurses as a group with the ability to provide "prompt work in teams in unexpected circumstances with many of the interventions guided by protocols" (p. 255).

Specific knowledge, skills, and attitudes have been identified as required for highly functional teams to prepare for and respond to emergencies. According to Slepiski (2007), emergency preparedness requires the team to have comprehensive knowledge, skills, and abilities in order to respond effectively to a natural disaster, as related high-risk job functions and accountabilities can cause legal action, harm, and even death. Nursing care delivered during an emergency requires team members to return back to basics, and what Giarratano et al. (2008) called advocacy in action, the delivery of nursing care challenged by technological disruptions and lack of care routines. The literature review revealed that during disaster events, nurses felt a deep sense of responsibility and obligations to both patients and other team members (see Appendix D, Table 3). Goodhue (2010) found disaster preparedness education and training fostered teamwork, provided the skills necessary for emergencies and crises, all while enhancing and reinforcing disaster response.

In summary, the literature review validated the presence of an ongoing knowledge gap on neonatal disaster preparedness, which supported the value of the proposed nursing educational program on neonatal evacuation training. The project provided for the development and implementation of an educational course involving disaster planning and activities that ultimately will ensure the health of neonates during the emergency evacuation of the NICU.

PROJECT IMPLEMENTATION METHODS

The quality improvement focus of the project allowed the evaluation of areas of performance in order to gain some measure of improvement related to neonatal disaster preparedness, thus influencing neonatal healthcare quality at the micro level (Moran, Burson, & Conrad, 2014). The educational course properties included disaster preparedness competencies as part of the curriculum content and the educational methodology to be used for content delivery. The alignment of educational objectives with selected competencies from national organizations, combined with a systematic approach in delivering content, has been linked with enhanced disaster preparedness educational outcomes (Jose & Dufrene, 2014).

The original plan for this quality improvement project was to conduct an initial tabletop exercise that included provision of an earthquake disaster scenario, followed by small work group discussion to discuss the appropriate course of action with task assignment. The exercise would assist in gathering information that would help improve the current NICU emergency evacuation plan and response to a disaster. Tabletop exercises have been used to train staff, identify weaknesses in the emergency plan and response, and provide opportunities to educate and train staff while improving a hospital's EOP (IEMSC, 2013). However, it became apparent to the author that the nurses had not received disaster training and education upon hire to the hospital, and so were unfamiliar with the hospital EOP and the NICU evacuation policy, unclear as to their expected roles and responsibilities in emergency neonatal evacuation, and untrained in the use of available equipment. Education and training needed to refocus on the NICU nurse in the emergency evacuation of neonates, i.e., on the hospital's disaster plan

response, the unit-specific evacuation plan, their roles and responsibilities, and use of available equipment. Participants received disaster preparedness content via face-to-face classroom lecture, role-playing exercises, video, and group discussion as part of the learning activities. Group problem-solving exercises have been recommended by the ILEMSC (2013) as “a way to teach and review with NICU staff their roles during a specific disaster or hospital-wide emergency” (p.8). Additional time was allotted to increase staff familiarity with evacuation equipment use via the role of evacuation nurse, which was randomly assigned. This strategy has been shown to strengthen skill levels (Hutchinson, Haynes, Parker, Dennis, McLin, & Welldaregay, 2011; Landry & Stockton, 2008). Participants completed pre- and post-intervention questionnaire surveys to assess if learning objectives across the domains were met, and if gains in disaster response knowledge and confidence were achieved. The feedback received from the surveys is discussed in the Results section.

Resources

The project was created as to be part of a larger quality improvement program and to create a more robust NICU-specific emergency response plan. Evidence-based resources of two neonatal disaster preparedness guidelines and a competency set were used to develop an educational course for nurses on evacuation procedures and expected roles as part of a department-specific policy and hospital-wide emergency management plan. The guidelines focused on the importance of pre-planning education and infant evacuation activities as part of a comprehensive NICU evacuation plan. The competency set identified measurable learning objectives for neonatal nurses as part of emergency preparedness and disaster response education and training (AWHONN, 2010).

CAN Neonatal Disaster Preparedness Toolkit

The CAN Neonatal Disaster Preparedness Toolkit (Carbine et al., 2015) has been endorsed by the California Perinatal Quality Care Collaborative, a group of public and private California healthcare leaders dedicated to improving the quality of neonatal care with the use of state-of-the-art quality improvement models. The toolkit provided guidance to ensure compliance with TJC Emergency Management Standards (2015). The guideline, based on community and best-practice models, was placed on the CPQCC toolkit website as a quality improvement intervention to facilitate quality patient care and improve clinical outcomes via efficient resource allocation.

IEMSC NICU/Nursery Evacuation Exercise Toolkit

The IEMSC NICU evacuation guideline (2009) was a collaborative effort of multidisciplinary NICU professionals based on experiential learning, the most current literature, and evidence-based practices. A series of three NICU evacuation exercises were facilitated by the IEMSC to assist Illinois' hospitals with guideline implementation into their EOPs. Ultimately, debriefing information from the exercises led to the development of the IEMSC toolkit (2013), which provided guidance on planning, conducting, and evaluation of NICU-specific evacuation exercises. The toolkit has been successful in providing opportunities to educate and training NICU staff in evacuation, identifying weaknesses in unit-based disaster preparedness plans, and improving hospitals' EOP.

AWHONN Core Competencies

The AWHONN Emergency Preparedness and Disaster Response: Competency-based Educational Objectives for Perinatal and Neonatal Nurses (Jorgenson et al., 2010)

guided the educational and training activities of the project. It was created to assist perinatal and neonatal nurses obtain the knowledge, abilities, and skills needed to protect the health and safety of their patients. The set contains measurable educational objectives that address the learning needs of neonatal nurses. Developed by a panel comprised of experts from nursing, medicine, and public health disaster management, it contains a total of seven competency domains and 19 core competencies. The educational activities focused specifically on those neonatal nursing core competencies related to emergency evacuation roles, procedures, and responsibilities within the following domains:

- Domain 1: Preparation and Planning;
- Domain 3: Incident Management and Support Systems;
- Domain 4: Safety and Security;
- Domain 5: Clinical and Public Health Assessment and Intervention;
- Domain 6: Contingency, Continuity, and Recovery; and
- Domain 7: Public Health Law and Ethics.

The competencies contained in the set, endorsed by key stakeholders including the American College of Obstetrics and Gynecology, American Academy of Pediatrics, and other national healthcare associations, are in alignment with TJC Emergency Management Standards.

Design

Components from the CAN Neonatal Disaster Preparedness Toolkit (2015), the IEMSC NICU/Nursery Evacuation Exercise Toolkit (2013), and the AWHONN Emergency Preparedness and Disaster Response Core Competency Set for Perinatal and Neonatal Nurses (2010) were used to provide quality improvement education for the

NICU nursing staff, identify weaknesses in the current NICU evacuation plan, and improve the overall hospital EOP. The project aims were to:

1. Assess the NICU nurses' knowledge of the staff roles and responsibilities in infant evacuation procedures
2. Educate the NICU nurses on the existing emergency infant evacuation protocol, including chain of command, equipment and supplies, and identification verification procedures
3. Evaluate the effectiveness of information from the toolkits and core competency set on increasing NICU nurses' awareness and knowledge of infant evacuation procedures within the hospital EOP
4. Identify opportunities for improvement in NICU evacuation emergency communication, access of resources, and training.

The educational course for staff on neonatal evacuation did not incur additional resources, costs, or time related to staff training, as the educational sessions were factored into the NICU annual operational budget as required non-patient care productive hours. Sessions were scheduled during staff meetings so as to be compensable training sessions per the requirements of the Fair Labor Standards Act. There was administrative commitment from the NICU leadership team, i.e., the Nurse Manager and Medical Director, who assisted in the facilitation of needed revisions in policies and procedures. Commitment was received from the Regional Director of Environmental Safety and Emergency Preparedness to support the integration of the neonatal evacuation policy as part of the larger hospital EOP. Based on prospective feedback on the implementation and evaluation of the neonatal educational project at the local level, the Director

requested the author to replicate the education and training project throughout the regional NICUs as feasible.

Protection of Human Subjects

The project proposal was presented to the PHCMC Institutional Review Board for the Protection of Human Subjects (IRB), where the IRB Chairman deemed the activities fell under the quality improvement (QI) category, which was not under the IRB's purview. The proposal, survey tools, and corresponding consent form were submitted to and approved by the California State University of Long Beach (CSULB) IRB.

Setting and Participants

This quality improvement project was conducted at PHCMC, located in Mission Hills, within the northeast San Fernando Valley of Los Angeles County in Southern California. The participant population consisted of 26 neonatal nurses between the ages of 26 to 60 years who provided care to neonates in the acute care setting of the NICU. None of the participants had received department-specific training and education on the PHC NICU emergency evacuation plan, their roles and responsibilities, and/or expectations of the hospital's disaster plan response. There was neither sampling procedures nor inclusion or exclusion criteria. Selection of participants was equitable as all RN staff members were required to participate in the educational program as part of their unit-based quarterly staff meetings in December. An appropriate sample size was obtained to ensure project validity, based on NICU nurses required attendance at staff meetings (except if on vacation or medical leave). As mentioned previously, the staff meetings are compensable training sessions per the requirements of the Fair Labor Standards Act.

Course Structure and Content

The NICU nurses were required to attend one of five scheduled unit-based quarterly staff meetings held during the month of December 2015. A full one-hour of the four-hour meeting was dedicated to the project's NICU evacuation education and training. The educational course was classroom based and tailored to the nurses' learning characteristics, i.e., adult-based learning. The concept integration of disaster preparedness was woven throughout the course design. Course objectives were drawn from major concepts from the AWHONN Emergency Preparedness and Disaster Response: Competency-based Educational Objectives for Perinatal and Neonatal Nurses (2010), CAN Neonatal Disaster Preparedness Toolkit (Carbine et al., 2015), IEMSC NICU/Nursery Evacuation Exercise Toolkit (2013), and TJC Emergency Management Standards Elements of Performance EM.02.02.03 Resources and Assets, EM.02.02.07 Staff, and EM.02.02.11 Patients (2015) as related to patient evacuation during disasters. Billings and Halstead (2012) stated that objectives should indicate what the participants should know and be able to do by the end of an educational course (see Appendix A). Additionally, continuing education units were offered as part of this quality improvement project, as this educational offering met the minimum time length requirements.

Lecture was delivered via a PowerPoint presentation, and focused on familiarizing the nurses with the overall hospital EOP, the departmental evacuation policy, their roles and responsibilities during emergency infant evacuation, and the use of the NICU emergency evacuation equipment. The presentation included pictures and a video to present the course content more effectively, stimulate participant discussion, enhance the nurses' problem-solving skills, and provide an opportunity for reflective

learning (Billings & Halstead, 2012). Handouts were distributed to the participants so the nurses could follow the sequence of the lecture. Teaching strategies and learning activities included small group discussions after introduction of each topic to assist in integration of new knowledge and facilitate the feedback lecture methodology. The IEMSC (2013) has recommended group discussion as “an effective method for reviewing (disaster) plans, procedures, and policies in a low stress and controlled environment” (p. 5). Semi-scripted role-playing and low-fidelity simulation was used to demonstrate the correct use of the unit’s evacuation vests; these approaches assisted in psychomotor skills development and acquisition as well as the opportunity to integrate critical thinking, problem solving, and decision-making skills related to the evacuation process. An 8-minute on-line video (YouTube) demonstrating a NICU evacuation drill from Loma Linda University Medical Center (2010) was shown to course participants at the end of the lecture. The video allowed debriefing and analysis of the critical event; it also enriched the classroom learning experience and stimulated further discussion (Billings & Halstead, 2012).

The methodology utilized for educational course provision offered the advantage of an efficient use of resources, requiring less cost and minimal time commitment while providing needed disaster preparedness training that could potentially improve disaster response and emergency plans.

PROJECT EVALUATION

Evaluation Methods

Survey evaluation methods, in the form of pencil and paper questionnaires, were used to obtain demographic information and to determine the effectiveness of the educational intervention on the change of nurses' knowledge, attitudes, and behaviors towards the evacuation process of inpatient, hospitalized neonates as part of NICU disaster preparedness. The questionnaires were reviewed for face validity and cognitive testing. A pretest-posttest design was selected to identify strengths, opportunities for improvement, and best practices. Information obtained from evaluations was used to assess the impact of the educational course, identify gaps in NICU policies and procedures, and develop future education and training.

Demographic Survey Structure

A survey questionnaire was administered for collection of demographic characteristics of the participants before each educational course was provided. Demographic information included sex/gender, age, race, ethnicity, level of nursing education, years of neonatal nursing experience, years worked at PHC NICU, and previous disaster education (see Appendix B).

Pretest/Posttest Survey Structure

Pre-testing and post-testing (see Appendix C) was utilized to determine whether the educational intervention increased participants' knowledge levels in the emergency evacuation of neonates. A 10-item survey questionnaire of closed-ended questions, i.e., multiple choice and Likert-scale, was utilized to measure knowledge, attitudes, behaviors, and perceptions on emergency neonatal evacuation. The survey was distributed to the

participants prior to the educational course for the collection of baseline data (pretest) and established participants' baseline knowledge, skills, and attitudes towards emergency neonatal evacuation. After the educational intervention, the same survey was redistributed post-education (posttest) in order to measure changes in knowledge, attitudes, and behavior as well as the effectiveness of the intervention. Use of the same survey questionnaire as both pretest and posttest eliminated instrumental bias, ensuring all changes were indicative of the effectiveness of the educational intervention.

Two sets of knowledge questions were posed to participants pre-training and post-training to determine the impact of attendance at the education and training session on neonatal evacuation. The two sets of knowledge questions, each measured in a common response format, required separate analysis. Knowledge items were combined together to form a scale, thereby decreasing the risk of encountering Type I errors.

The first set consisted of six multiple-choice questions that assessed the participants' knowledge of the existing NICU evacuation policy. Questions such as, "the following infants are evacuated last," were followed by four multiple-choice options. Each question had only a single correct answer. An index was created by adding the number of questions that participants answered correctly, yielding scores ranging from a minimum score of 0 to a maximum score of 6.

The second battery consisted of questions assessed the participants' self-efficacy by measuring their level of agreement with statements like, "I can correctly describe the NICU chain of command in emergency response." Participants responded on a 4-point Likert scale where higher scores reflected stronger agreement with the statement. A scale

was created by adding together participants' scores on these four questions, yielding possible scores ranging from 4-16.

Survey Responses

Data were gained and the effectiveness of the NICU evacuation educational intervention captured, summarizing changes in knowledge, attitudes, and behaviors. Data were manually entered into an Excel spreadsheet and then imported into SPSS version 22 for analysis. Measures of central tendency were generated to describe nurses' baseline characteristics and summarize knowledge, attitudes, and behaviors prior to the educational course. SPSS was used to calculate summative average responses to each question/item, i.e., average overall respondent scores for closed-ended questions, and for further analyses as indicated, e.g., paired sample t-tests to determine statistical significance in pretest and posttest values.

PROJECT RESULTS

Of the 33 neonatal nurses who attended the educational course held as part of the five scheduled unit-based quarterly staff meetings in December 2015, 26 (79%) participated in completion of demographic surveys and pretests/posttests.

Demographics

The participants' demographic characteristics are presented in Table 1. On average, the age of the nurses was 46.5 years. The number of years in NICU nursing was 13.8 years. The majority of the participating nurses were female (92.3%), white (61.5%), and non-Hispanic (80.8%), with most having earned their bachelor's of science in nursing (68%). The majority of the nurses have worked more than two years in the PHC NICU (61.5%).

Interestingly, although formal education and training on neonatal evacuation has never been offered to the nursing staff since the NICU was opened three years ago, there was 1 respondent who stated that that training had been provided upon hire to the PHC NICU. There were also 3 respondents who stated that neonatal evacuation training had been offered to them annually at PHC. Eleven nurses responded that they had received neonatal evacuation training at other hospitals where they worked.

Table 1

Pre/Post Survey Descriptive Statistics for Registered Nurses Attending Neonatal Intensive Care Unit Infant Evacuation Training and Education (n = 26)

Demographics		Mean	SD
Age		46.5	10.6
Years in NICU nursing		13.8	9.5
		n	Valid %
Sex/Gender	Female	24	92.3
	Male	2	7.7
	Other	0	0
Race	American Indian or Alaska Native	0	0
	Asian	8	30.8
	Black or African American	0	0
	Native Hawaiian or Pacific Islander	1	3.8
	White	16	61.5
	More than one race	1	3.8
Ethnicity	Hispanic or Latino	5	19.2
	Not Hispanic or Latino	21	80.8
Highest nursing degree obtained			
	Diploma	0	0
	Associate's Degree	7	28.0
	Bachelor's Degree	17	68.0
	Master's Degree	1	4.0
	Doctoral Degree	0	0
Years worked in PHC NICU	< 1 year	4	15.4
	1 year	5	19.2
	2 years	1	3.8
	> 2 years	16	61.5
Training on hire	Yes	1	3.8
	No	25	96.2
Training annually	Yes	3	11.5
	No	23	88.5
Training at other hospital	Yes	11	42.3
	No	15	57.7

Knowledge

In order to determine whether participants' knowledge of the NICU infant evacuation policy increased after participation in the training session, a paired-samples t-test was conducted comparing participants' pretest to posttest knowledge scores. The paired samples t-test revealed a statistically significant increase in the participants' scores from pretest ($M = 2.73$, $SD = 1.31$) to posttest ($M = 5.58$; $SD = 0.51$; $t(25) = 10.77$, $p < .001$, $d = 2.37$). Examination of Cohen's D, a measure of effect size, revealed this to be a very large effect, which supported the conclusion that this represented a clinically meaningful increase in NICU nurses' knowledge of the infant evacuation policy.

Because a statistically significant increase in nurses' knowledge scores was observed, it was decided to run a series of post hoc Chi-square Tests of Independence in order to determine which competencies specifically nurses were uncertain of prior to training (see Table 5).

Table 5

Knowledge of Intensive Care Unit Infant Evacuation Policies Before and After a Work-Based Training Session (n = 26)

Question	Percent Answered Correctly		p
	Pre	Post	
1. Providence Holy Cross Medical Center's emergency operation plan addresses...	30.77	76.92	.001
2. Evacuation of infants from the NICU during a disaster is directed by the...	50.00	100	< .001
3. In addition to one identification band on an extremity, the nurse...	26.92	100	< .001
4. If evacuating an infant with intravenous fluids...	65.38	92.31	.02
5. The following infants are to be evacuated last...	92.31	96.15	.55
6. The following items are placed in the infant's bed during evacuation when possible...	7.69	92.31	< .001

As seen in Table 5, not only did the participants' knowledge scores significantly increase from pretest to posttest, it is also evident from that their baseline knowledge was fairly low on most questions. Thus, the educational intervention was definitely warranted. The only question not showing a significant increase, #5 "The following infants are evacuated last . . .", appears due to a ceiling effect, i.e., the baseline scores were so high that there was not much room to increase at posttest.

Self-efficacy

In order to determine whether participants' reported level of self-efficacy increased after participation in the training session, a paired-samples t-test was conducted comparing participants' pretest to posttest self-efficacy scores. The paired samples t-test revealed a statistically significant increase in participants' scores from pretest ($M = 11.19$, $SD = 2.70$) to posttest ($M = 14.35$; $SD = 1.81$; $t(25) = 7.42$, $p < .001$, $d = 1.56$). Examination of Cohen's D revealed this to be a very large effect, supporting the conclusion that this represents a clinically meaningful increase in nurses' self-efficacy in implementing the NICU infant evacuation policy.

Because a statistically significant increase in nurses' self-efficacy scores was observed, it was decided to run a series of post hoc paired samples t-tests of Independence in order to determine which competencies specifically nurses were uncertain of prior to the training (see Table 6).

Table 6

Self-Efficacy Towards Implementing Intensive Care Unit Infant Evacuation Policies Before and After a Work-Based Training Session (n = 26)

Question	Mean Score		p
	Pre	Post	
1. I can identify and locate the NICU emergency response plan.	3.00	3.65	<.001
2. I can correctly describe the NICU chain of command in emergency response.	2.77	3.65	<.001
3. I feel comfortable with my roles and responsibilities during a NICU evacuation.	2.69	3.58	<.001
4. I can correctly demonstrate the use of neonatal evacuation equipment.	2.73	3.46	<.001

CONCLUSIONS

Summary

Participants' baseline knowledge of the hospital EOP, NICU emergency evacuation policy and procedures, nursing staff members' roles and responsibilities, and use of evacuation equipment was fairly low. These results were consistent with Femino et al.'s (2013) study findings that most NICU nurses have little knowledge regarding unit and hospital emergency response planning. Prior to the educational intervention, nurses felt uncertain of their knowledge and competency in the identified items to be taken with the infant during evacuation, the infant identification process, and components addressed in the hospital EOP. Knowledge on these three items increased from 8% to 92%, 27% to 100%, and 31% to 77% respectively. The educational course participants' knowledge scores significantly increased from pretest to posttest, supporting the author's hypothesis that an educational intervention on neonatal evacuation was indicated. Statistical testing supported findings that that participants' knowledge of the NICU infant evacuation policy was meaningfully increased, consistent with IEMSC (2013) research that indicated nursing must included in emergency planning and education, in addition to the core principles of disaster management.

Secondly, the participants' perceived level of readiness (self-efficacy) to perform an unplanned emergency management plan significantly increased on all items. Statistical testing revealed a statistically significant increase in participants' scoring from pretest to posttest with a very large effect, supporting the conclusion of a meaningful increase in nurses' self-efficacy in their ability to implement the NICU infant evacuation policy. Before the educational course, the majority of participants lacked familiarity with the

NICU emergency response plan and its components. There was lack of clarity related to the chain of command during a disaster response and identified roles and responsibilities. The vast majority of nurses acknowledged never accessing or donning the evacuation vests, despite indicating on the survey that they could correctly demonstrate use of the equipment. Indeed, the author revealed to participants that the evacuations vests had been identified as missing from their designated area the day before the educational intervention began, and provided visual confirmation of the missing equipment (see Appendix A). Innovators and early adopters readily volunteered to don the vests in each course offering, thus providing a hands-on demonstration/practice session that visibly showed the donning process and modeled the evacuation skill.

Lastly, the quality improvement project findings provided insights on current knowledge and practice gaps in neonatal disaster preparedness, and associated clinical and regulatory implications. Another valuable output resulting from this quality improvement project was the formation of a nursing NICU Disaster Preparedness Task Force to identify and study opportunities for improvement. The task force has since been reconfigured into an appointed, on-going interprofessional, multifacility committee, chaired by the author, and presents findings and proposed solutions on NICU disaster preparedness and emergency management issues to hospital and regional disaster preparedness administration. The education and training course, as well as other deliverables from the project, will be replicated as in-person or on-line presentations at other NICUs within the Southern California Providence hospital system that are seeking to improve neonatal disaster preparedness. The findings from this project support the need for system-wide provision of neonatal disaster preparedness and emergency

management instruction and education that includes a protocol addressing neonatal evacuation.

Future Plans

The NICU educational course was the first step in the revision of the current NICU infant evacuation policy and in the development of a larger quality improvement program for NICU disaster preparedness. Based on project findings, expansion of processes will include revision of the department-specific policy, related to the safe and efficient evacuation of neonates. Neonatal disaster planning and preparedness components are being added to the unit policy and hospital EOP with the support of the NICU Nurse Manager, Regional Disaster Preparedness Coordinator and Regional Director of Environmental Safety and Emergency Preparedness. A NICU emergency response call tree was created, and unit innovators are creating evacuation backpacks, which will be readily available at each neonate's bedside. Based on feedback from the educational course, additional evacuation supplies and equipment, i.e., an infant evacuation sled, two infant evacuation baskets, two two-way radios, and twenty emergency searchlights, were purchased by the Regional Director for the NICU. Infant-specific supplies and equipment are being identified and added to the hospital disaster preparedness identified staging areas.

As a result of the quality improvement project, education and training on neonatal evacuation and/or disaster preparedness will be included as a standing agenda item on the quarterly staff meetings for 2016. First-quarter 2016 staff meetings' disaster/emergency education addressed emergency management of hospital-wide security alert of incidents including violence, criminal activities, or other situations where a person is posing a

threat to the safety of NICU patients and/or staff and enhanced security is required. Second-quarter staff meetings' education is to include training on use of the new evacuation equipment. Future plans include unit-based exercises, i.e., tabletop and simulation drills, and functional and full scale exercises that will have the ability to test NICU and hospital EOP evacuation plans, procedures, staff, and emergency response capabilities. As previously discussed, planning is in place to expand education and training throughout the Southern California system of NICUs.

This quality improvement project and resulting recommendations will ensure a more comprehensive approach to hospital planning, preparedness, and testing activities of disaster preparedness and emergency management in alignment with TJC recommendations of addressing neonatal disaster planning as a part of a hospital's EOP. The processes provide guidance for the NICU and hospital on compliance with TJC requirements for clear definitions of staff roles and responsibilities during disasters and emergencies. It will assist in sustaining staff competencies over time, ensure function as a successful overall evacuation strategy, and ultimately safeguard health outcomes of neonates, the most vulnerable hospital population.

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APPENDIX A

NICU EVACUATION SAMPLE EDUCATION SLIDES

Objectives

At the end of this training, you will be able to:

1. Recognize the relationship between the NICU Evacuation Policy and Providence Holy Cross Emergency Operations Plan.
2. Identify the NICU RN's roles and responsibilities during an unplanned emergency evacuation of infants.
3. Utilize emergency evacuation equipment.

Background

October 29, 2012: Hurricane Sandy descends on New York City

- NYU Langone Medical Center evacuates 21 infants



August 29, 2005: Hurricane Katrina devastates New Orleans

- Evacuation of 16 infants from Memorial Medical Center





Photo of infant being evacuated by boat taken by Thomas P. Butcher, RN, University Hospital Emergency Preparedness Director.

Problem Statement

Well defined Emergency Operations Plan (EOP)

- What are the expectations of the disaster plan response?

Basic NICU departmental policy for infant evacuation

- What are our roles & responsibilities?
- What kind of equipment do we have available?

Improve processes related to safe & efficient evacuation of infants w/ incorporation of NICU-specific guidelines

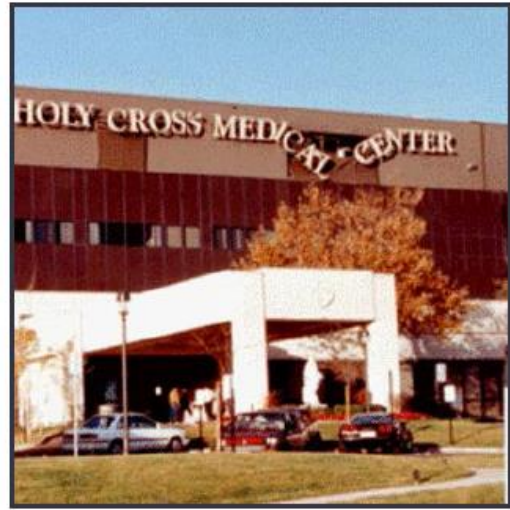
- Responds to The Joint Commission (TJC) standards for comprehensive hospital EOP (TJC, 2015)

Why Disaster Preparedness?

1971 Sylmar Earthquake



1994 Northridge Earthquake



Emergency Operations Plan (EOP)

What is it and what does it address?

- General plan – not a policy – during a disaster
- Outlines general staff roles & responsibilities

What it is **not**

- Detailed policy & procedure for unit or its patients

Where Is It?

Do NOT look for it on
the Intranet in
PolicyStat.

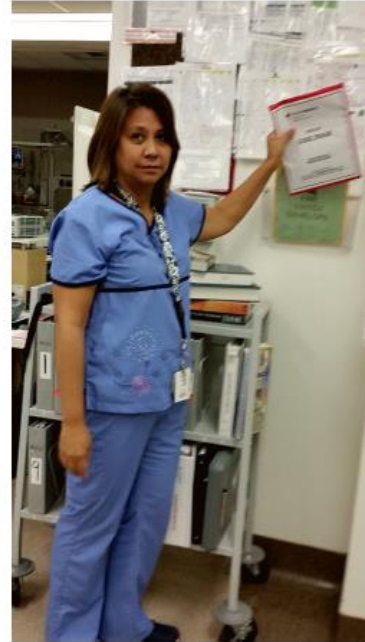
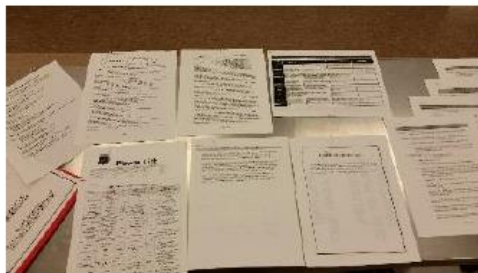
- Why? Because it is
a Plan, not a Policy.

You can find it in the
Chart Rack.



What Do I Do First?

1. Don't grab the EOP Manual first - grab the Code Triage envelope.
2. Fill out the forms.
3. Remain in contact w/ the Command Center.



NICU Dept. Policy: PHC-NICU-E01

Medical Center		Providence Holy Cross Medical Center Departmental Policies	
Subject:	Evacuation	Category:	Neonatal Intensive Care Unit
Effective Date:	11/01/10	Number:	PHC-NICU-E01
POLICY			
It is the policy of Providence Holy Cross Medical Center that in the event of an internal or external disaster, the Neonatal Intensive Care Unit (NICU) adheres to the guidelines outlined in the hospital's Disaster Manual.			
PURPOSE			
The purpose of this policy is to provide a guideline for the safe and orderly evacuation of patients cared for in the NICU.			
PROCEDURE/ GENERAL INSTRUCTIONS			
1. Disaster evacuation plan for NICU consists of, but is not limited to the following:			
A. NICU Charge nurse directs evacuation of infants from NICU.			
1) Notifies the unit when to evacuate			
2) Organizes evacuation and remains in the unit until evacuation is complete			
2. All infants are to have at least one identification band on an extremity			
A. Using a skin marking pen, the nurse is to write the infant's name on either the sole of the infant's foot, forehead, or back			
3. Efforts are made to evacuate all infants in the NICU, regardless of condition.			
4. All IV's are placed on saline lock whenever possible. Portable IV pumps are used only for infants where a lifeline is necessary.			
5. Stable infant may be evacuated via evacuation apron, bassinet, or in hospital employee/parent's arms.			
6. If necessary, place as many stable infants as possible in one isolette/crib for relocation.			
7. Infants on ventilators/and or oxygen support are transported last. Ventilated infants placed in a transport isolette with a transport ventilator or manually ventilated by the respiratory care practitioner (RCP).			
8. Copy of infant's medical record is placed in the bed with infant when possible. Otherwise, unit secretary or designated person is responsible for evacuating medical records.			
9. Charge nurse is responsible for the evacuation of narcotics and medications when conditions permit.			
10. Respiratory care practitioners are responsible for the evacuation of extra oxygen tanks.			
11. Refer to the "Disaster Manual" for further details related to disaster procedures and/or forms to be completed.			
REFERENCE(S)/ RELATED POLICIES			
NANN Guidelines for Neonatal Nursing Policies, Procedures, Competencies, & Clinical Pathways, 4th Edition (2005). Leslie Altmier, Beth Brown, Laurie Tedeschi			
PHCMC Code Zero Evacuation Procedures			

Follow the NICU Evacuation P&P...

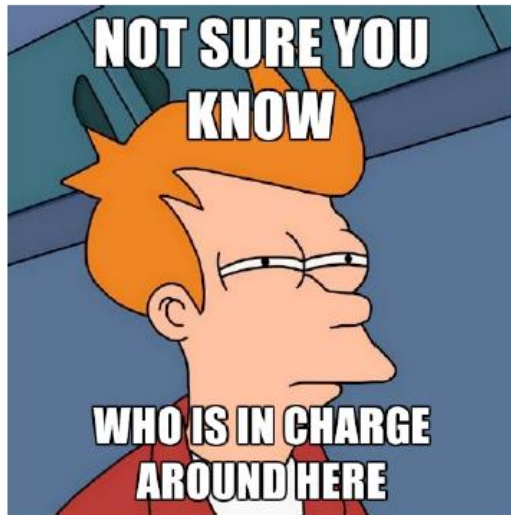
1. Where do I find it?
2. Who's in charge?
3. What do I do?
4. Where's our stuff?



1. On the Intranet – in PolicyStat

2. In the NICU Code Triage Envelope – hard copy is available

Who's In Charge?



Pick one or more...

- **Charge RN**
- Manager/Supervisor
- Neonatologist
- Hospital Incident Commander

What Do I Do?

Ensure your infant is safe, then prepare to evacuate:

1. Ensure your patient has at least 1 ID band on.
2. Write the patient's name on the foot, forehead or back (we have special pens!)
3. Saline lock IVs – use pumps for lifelines.
4. Get copy of medical record (if able).

Leave behind: IVs & meds, breastmilk, formula & nipples, diapers & wipes, narcotics, etc.

Who is Evacuated First?

“Efforts are made to evacuate all infants in the NICU, regardless of condition.”

“Infants on ventilators/and or oxygen support are transported last.”

- Evacuate stable infants using evacuation aprons, bassinets, or hospital employee/parent's arms.
- As many stable infants as possible in incubator/bassinet.

Where's Our Stuff?



Do we have evacuation equipment?

- Yes we do!

Where are they located?

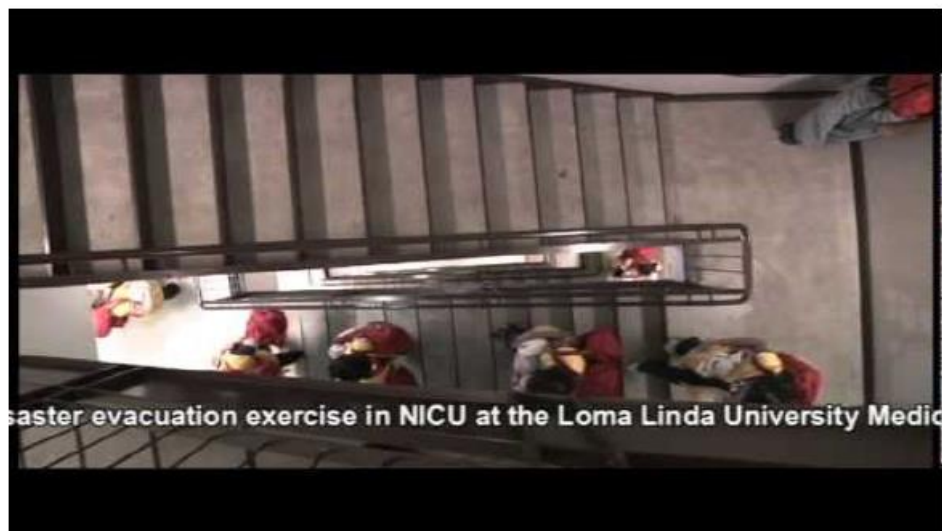
- Infant aprons are on wall across from ABG Room in the NICU.

Are You Sure They Are There?



Based on EBP Resources

- *AWHONN Emergency Preparedness and Disaster Response Core Competency Set* (Jorgenson et al, 2010)
- *California Association of Neonatologists Neonatal Disaster Preparedness Toolkit* (Carbine et al, 2015)
- *Illinois Emergency Medical Services for Children NICU Evacuation Guidelines* (IEMSC, 2009 & 2013)
- *Pediatric/Neonatal Disaster Reference Guide* (LLUCH, 2013)
- *The Joint Commission 2015 Hospital Accreditation Standards: Emergency Management* (TJC, 2015)



<https://www.youtube.com/watch?v=co8t4soXWyw>

Evacuation Preparation



1. Review & revise the policy
2. Know your role & responsibilities
3. Practice with the Evacuation Vests

More to come...

APPENDIX B

DISASTER PREPAREDNESS: DEMOGRAPHIC SURVEY

Disaster Preparedness:

Neonatal Intensive Care Unit Infant Evacuation
Demographic Characteristics of RNs Attending Training

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INSTRUCTIONS: In order to keep your answers confidential, please do not write your name on this questionnaire. Instead, enter the last 4 (four) numbers of your cell phone number in the boxes above.

Please answer the following questions by checking the appropriate box or filling in the blank. Please check only one answer. Thank you for your participation.

1. What is your sex/gender?
☐ Male ☐ Female ☐ Other _____
2. What is your age?
 _____ years of age
3. Please indicate your race:
☐ American Indian or Alaska Native ☐ Native Hawaiian or Pacific Islander
☐ Asian ☐ White
☐ Black or African American ☐ More than one race
4. Please indicate your ethnicity:
☐ Hispanic or Latino ☐ Not Hispanic or Latino
5. What is the highest nursing degree you have obtained?
☐ Diploma ☐ Master's Degree
☐ Associate's Degree ☐ Doctoral Degree
☐ Bachelor's Degree
6. How many years of experience do you have in NICU nursing?
 _____ years
7. How many years have you worked in the NICU at PHC since it opened in March 2012?
☐ < 1 year ☐ 2 years
☐ 1 year ☐ > 2 years
8. Did you receive neonatal evacuation education and training upon hiring at PHC?
☐ Yes ☐ No
9. Have you received annual neonatal evacuation education and training at PHC?
☐ Yes ☐ No
10. Have you received neonatal evacuation education and training at another hospital(s)?
☐ Yes ☐ No

Thank you for your participation in this program.

APPENDIX C

DISASTER PREPAREDNESS: PRE/POST TEST SURVEY

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DISASTER PREPAREDNESS:
 NEONATAL INTENSIVE CARE UNIT INFANT EVACUATION TRAINING
 PRE/POST TEST QUESTIONS

INSTRUCTIONS: In order to keep your answers confidential, please do not write your name on this questionnaire. Instead, enter the last 4 (four) numbers of your cell phone number in the boxes above. Please answer the following questions by circling the correct answer for each question. There is only one correct answer. Thank you for your participation.

1. Providence Holy Cross Medical Center's emergency operation plan addresses
 - a. Detailed evacuation procedures for all patients in all units, including those in the NICU.
 - b. Medical and nursing staff's general role and responsibilities during disaster events.
 - c. Sentinel events.
 - d. All of the above.

2. Evacuation of infants from the NICU during a disaster is directed by the
 - a. NICU Charge RN.
 - b. NICU Manager/House Supervisor.
 - c. Neonatologist-on-Call.
 - d. Hospital Incident Commander.

3. In addition to one identification band on an extremity, the nurse
 - a. Writes the infant's name using a skin-marking pen on the chest or abdomen.
 - b. Writes the infant's name using a skin-marking pen on the foot, forehead, or back.
 - c. Places a preprinted identification label on the infant's cap and secures with tape.
 - d. A and C.

4. If evacuating an infant with intravenous fluids
 - a. Hep lock all IV lines, including central lines.
 - b. Change administration set to gravity burette (60 drops/mL) and remove from IV pump.
 - c. Saline lock IV line when possible, using IV pumps only for infants who need lifelines.
 - d. Keep the IV lines on IV and/or syringe pump.

5. The following infants are to be evacuated last
 - a. Stable infants.
 - b. Infants on oxygen modalities including CPAP and ventilators.
 - c. Those infants as identified per the NICU Nurse Manager/House Supervisor.
 - d. Those infants as identified per the Hospital Incident Commander.

6. The following items are placed in the infant's bed during evacuation when possible
 - a. Medical records.
 - b. Medications, including IV fluids and narcotics.
 - c. Nutritional and hygiene supplies (breast milk/formula, nipples, diapers, wipes).
 - d. All of the above.

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DISASTER PREPAREDNESS:
**NEONATAL INTENSIVE CARE UNIT INFANT EVACUATION TRAINING
PRE/POST TEST QUESTIONS**

Please circle the number that best represents your response to each statement.

	Strongly Disagree	Disagree	Agree	Strongly Agree
7. I can identify and locate the NICU emergency response plan.	1	2	3	4
8. I can correctly describe the NICU chain of command in emergency response.	1	2	3	4
9. I feel comfortable with my roles and responsibilities during a NICU evacuation.	1	2	3	4
10. I can correctly demonstrate the use of neonatal evacuation equipment.	1	2	3	4

Thank you for your participation in this program.

APPENDIX D

TABLES OF EVIDENCE

Evidence Table 1. *Disaster Preparedness/Evacuation Guidelines & Resources*

Purpose/Author/Year	Sample/Setting	Framework/Concept/Tool	Results	Implications
Guidance in development of comprehensive disaster response plans (Carbine, Cohen, Hopper, Murphy, Phillips & Powers, 2015)	Neonatal & perinatal patients	CAN Neonatal Disaster Preparedness Toolkit	Response plans based on community, best practice models, & compliance with TJC	Knowledge of where NICU falls in communication & response chain of command Staff understands expected roles & responsibilities References provided for further training
Guide to assist NICU professionals and emergency planners in planning and preparation for evacuation (IEMSC, 2009)	Perinatal administrators, neonatal nurses, neonatologists, transport coordinators, emergency planners, hospital coordinators, & public health representatives from NICU Evacuation Committee in IL	NICU Evacuation Guidelines	Expansion of resources available to healthcare facilities to improve pediatric emergency care Preparedness is continuous process	Guide aims at pre-planning with recommendations & education Strategic flow to be utilized with evacuation
Tabletop exercises to assist hospitals to implement & incorporate guidelines into EOPs (Illinois Emergency Medical Services for Children, 2013)	3 separate exercises held in IL, MO & WI	NICU/Nursery Evacuation Tabletop Exercise Toolkit with Sit Man, MSEL, EEG, AAR, & IP	All exercises forced NICU evacuations, coordinating mobilization of medically fragile & technologically dependent infants	Exercise scenario was earthquake related, with the NICU forced to evacuate due to damage sustained to hospital structure

Purpose/Author/Year	Sample/Setting	Framework/Concept/Tool	Results	Implications
Template to guide emergency preparedness & disaster response education and training (Jorgensen, Mendoza, & Henderson, 2010)	Perinatal & neonatal nurses	Nationally derived consensus-based core competency set Contains 7 competency domains & 19 core competencies	Identification of measureable objectives that address learning needs during disaster events Competency set derived and agreed upon by medical, nursing, & PH disaster management professionals Reviewed & accepted by AAP, ACP, ACS, AHA, & ANA	Competency set can be used to train, educate, & evaluate RNs according to expected role in disaster Core competencies in alignment with TJC EM standards for hospitals
Integrative review on educational competencies & technologies for disaster preparedness (Jose & Dufrene, 2014)	Retrieved articles (n = 190) with 8 research articles meeting inclusion criteria	Suitable disaster preparedness competencies Suitable methods of instruction to deliver disaster preparedness content	Studies used reputable resources from national organizations, incorporated different methods of disaster simulation	Tailor disaster preparedness educational programs to educational objectives with selected disaster preparedness competencies
Resources to aid in the development or enhancement of emergency, obstetrical, neonatal, & pediatric emergency operations planning (Loma Linda University Children's Hospital, 2013)	Multidisciplinary emergency care & disaster professionals from California Neonatal/Pediatric Disaster Coalition in CA	Pediatric/Neonatal Reference Guide	Culmination of best practice, expert opinion, & plans Generated neonatal specific disaster plans and templates	Guide to assist in development of hospital EOP & department-specific emergency plan In-patient units need to prepare for disasters & not rely on other areas for their populations Contains tabletop exercise & drill recommendations

Purpose/Author/Year	Sample/Setting	Framework/Concept/Tool	Results	Implications
Expert guidance on emergency management planning process (The Joint Commission, 2005)	Vulnerable populations, i.e., infants	Strategies, processes, & tools for coordinated emergency management planning	Expert guidance on emergency management process	Healthcare providers & practitioners responsible for initiation & coordination of emergency management planning Ensure thorough planning related to infants & children
Preparation of hospital staff for disaster response (The Joint Commission, 2012)	Volunteers (n = 50) from children's hospital in CA	One-day emergency preparedness training via game-style competition based on HVA findings	Disaster hypotheticals require quick, effective responses Encouraged active participation, teamwork, & innovations	Teams practiced evacuating patients simulated by baby dolls in record time, created transport equipment, & answered disaster-related (earthquake) questions
New & revised elements of performance (The Joint Commission, 2013a)	All levels of hospital staff affected	Comprehensive approach to planning, preparedness, testing, & activities per TJC EM.03.01.03	Requires organization to consider staff input when evaluating event exercises & responses	Relevant input from all levels of staff affected by emergency response exercises needed
Learnings on disaster preparedness (The Joint Commission, 2013b)	Patients (n = 1200) evacuated from 3 healthcare facilities in NYC, NY	EM standards & EPs	Create evacuation strategy as part of EOP & rehearse during drills at least 2x/year.	Conduct drills per EC.03.01.03, EP 1
Disaster preparedness requirements for hospital accreditation (The Joint Commission, 2015)	Hospitalized & in-patient populations	EM standards, EPs in EM.02.01.01 through EM.03.01.03	Determination of priorities for & deployment of resources to support response system, including trained personnel	Importance of hospital EOP compliance with TJC standards

Note: AAP = American Academy of Pediatricians, AAR = After Action Report, ACP = American College of Physicians, ACS = American College of Surgeons, AHA = American Hospital Association, ANA = American Nurses Association, CA = California, CAN = California Association of Neonatologists, Dept. = Department, EEG = Exercise Evaluation Guide, EM = Emergency Management, EP = Elements of Performance, EOP = Emergency Operation Plan, HVA = Hazard vulnerability analysis, IEMSC = Illinois Emergency Medical Services for Children, IL = Illinois, IP = Improvement Plan, MO = Missouri, MSEL = Master Scenario Exercise List, NICU = Neonatal Intensive Care Unit, NY = New York, NYC = New York City, PH = Public Health, SitMan = Situation Manual, TJC = The Joint Commission, WI = Wisconsin.

Evidence Table 2. *Disaster Preparedness/Evacuation Quantitative Studies*

Purpose/Author/Year	Design/Sample/ Setting	Framework/Concept/Tool	Results	Implications
Examination of ability & willingness of healthcare personnel to report to work setting following disasters (Adams & Berry, 2012)	Descriptive exploratory Healthcare personnel (n = 1342) in TX	Modification of Qureshi's Disaster Survey	Range from 10-30% unable or unwilling to report to work, primarily due to responsibility of children ($p < .05$)	Multiple barriers affect staff's ability & willingness to respond during disasters
Description of current status of nurse preparedness to manage disasters (Baack & Alfred, 2013)	Descriptive, correlational Key variable: Factors influencing nurses' actions to achieve personal growth & development to be prepared for major disasters RNs (n = 620) at rural hospitals in TX	Disaster Readiness Questionnaire: Self-regulation measured via SR Scale, perceived competence measured via EPIQ, & NAR; Job Satisfaction Questionnaire Deci's Self-determinism Theory Four basic factors related to engagement: individual differences, self-regulation, perceived competence, & healthcare climate	Average 42-years-old, 15 years experience RNs (84%); White (86%); Critical Care (20%), M/S (19.8%), & other (33%) EPIQ median of 82.5 & mean of 90 suggested low overall perceived competence to familiarity with disasters NAR sum scores indicated RNs felt unprepared to effectively respond to disasters Significant correlation of previous participation in major disaster event ($p < .001$) & prior work in a post-disaster shelter ($p < .001$) w/ EPIQ total score Significant predictors of participation in major disaster ($p < .001$), past experience in post-disaster shelter ($p = .024$), & SR ($p < .001$)	Focus of study was actions to prepare RNs to respond to disasters. Positive correlation between previous experience & higher EPIQ scores indicate "hands-on" training or participation in actual events may increase perceived preparedness & actual abilities in preparedness RNs sought opportunities to participate in actual disaster events, mock drills, & educational opportunities

Purpose/Author/Year	Design/Sample/ Setting	Framework/Concept/Tool	Results	Implications
Evaluation of awareness & use of NYSDOH Pediatric & Obstetric Emergency Preparedness Toolkit by upstate NY hospitals (Clancy & Kacica, 2012)	<p>Mixed method qualitative/quantitative cross-sectional structured survey</p> <p>DV: NY hospitals' emergency preparedness planning</p> <p>IV: Awareness & utilization of toolkit & presence of pediatric emergency preparedness planning elements</p> <p>Hospitals (n = 145) in NY</p>	<p>Emergency Preparedness Toolkit</p>	<p>Hospitals with ≥ 1 pediatric bed more likely to have EMP for pediatric patients ($p < .0223$) & have appointed pediatrician coordinator</p> <p>Closed-ended questions results reported "yes" responses; "not necessary" was primary response for not having clinical coordinators, cited in previous literature as due to lack of awareness of pediatric surge planning; MD coordinator ($p < .0001$) & pediatric clinical coordinator significantly associated with presence of pediatric emergency plan elements ($p < .001$)</p> <p>AAP, ACEP, & ENA joint recommendation of MD coordinator & RN coordinator appointments</p>	<p>Study demonstrated need for training exercises & drills, educational materials, & proactive management planning</p>
Impact of NICU vertical evacuation exercise on infant hospital emergency preparedness (Femino, Young, & Smith, 2013)	<p>Quantitative retrospective review*</p> <p>DV: Hospital emergency preparedness plan</p> <p>IV: Full-scale evacuation exercise</p> <p>Simulated infants (n = 34) at hospital in MA</p>	<p>BIDMC HICS 260 Patient Evacuation Tracking Form</p> <p>Relative Rate-Limiting Steps of the Evacuation & Amount of Time They Required Table</p>	<p>All infants evacuated within 3 minutes, including 12 infants on ventilators & 3 infants with complex medical issues, ultimately relocated into holding areas within 23 minutes</p>	<p>*Not true quantitative non-experimental retrospective research with case-control design, data for IV based on recollection (retrospection)</p> <p>Exercise useful for evacuation</p>

Purpose/Author/Year	Design/Sample/ Setting	Framework/Concept/Tool	Results	Implications
Determination of effectiveness of disaster preparedness education (Hutchinson, Haynes, Parker, Dennis, McLin, & Welldaregay, 2001)	Pretest/post-test experimental design Nursing school students (n = 81) in LA	Pre-test & post-test survey questionnaire	Differences in pretest & posttest scores (p = 0.05) Classroom didactic content, followed by simulated learning experience, an effective teaching strategy in disaster preparedness	Simulation exercises include didactic, discussion, table top, role-playing, without low or high fidelity simulation use
Evaluation of nurses' role in disaster preparedness (Landry & Stockton, 2008)	Basic post-test experimental design* Staff members (n = 22) & 30 nursing students (n = 30) at university in CA	Self-administered post-test survey Curriculum developed by INCMCE	Hands-on practice preferred (40.8%) by both groups	*Not a true post-test (after-only) experimental design, reliability & validity of authors' tool unreported Randomly assigned roles strengthen students' skill levels Curriculum should include equipment use with demonstration Consider preferred learning methods of participants

Note: AAP American Academy of Pediatricians, ACEP = American College of Emergency Physicians, BIDMC = Beth Israel Deaconess Medical Center, CA = California, DV = Dependent Variable, ED = Emergency Department, EMP = Emergency Management Plan, ENA = Emergency Nurses Association, EPIQ = Emergency Preparedness Information Questionnaire, HICS = Hospital Incident Command System, INCMCE = International Nursing Coalition for Mass Casualty Education, IV = Independent Variable, LA = Louisiana, MA = Massachusetts, MD = Medical Doctors, M/S = Medical-Surgical, NAR = Nurse Assessment of Readiness, NY = New York, NYSDOH = New York State Department of Health, RN = Registered Nurse, SR = Self-Regulation, TX = Texas.

Evidence Table 3. *Disaster Preparedness/Evacuation Qualitative Studies*

Purpose/Author/Year	Design/Sample/ Setting	Framework/Concept/Tool	Results	Implications
Share meanings of perinatal nurses' provision of care experiences during natural disaster (Giarratano et al., 2008)	Interpretative (hermeneutical) phenomenology Key variable: Psychological distress in perinatal nurses Perinatal nurses (n = 16) at 7 agencies in LA	Van Manen's process of thematic analysis-guided data analysis Semi-structured, in-depth (1-2 hour) interviews, peer debriefing, reflective journaling	Data saturation after 10 interviews, with 6 additional interviews to confirm grasp of experience meaning Nurses worked at full evacuation sites (n = 12) & worked at open but varied limited operation sites (n = 4) L&D 37%, maternal-newborn 35%, NICU 21%, ambulatory care 7% nurses	Nursing clinical implications of living through situational uncertainty with preparation to adapt to arising needs in patient care & self-preservation Ongoing support required to rebound & cope with trauma exposure
Description of strengthening healthcare providers' teamwork & institutional disaster preparedness (Goodhue, Burke, Chambers, Ferrer, & Upperman, 2010)	Descriptive qualitative analysis Key variable: Pediatric-focused disaster exercises Healthcare workers (n = 86) at tertiary pediatric hospital in CA	Web-based Disaster Olimpix Satisfaction Survey	Mean scores: perception of performance, 3.8/5; perception of utility, 4.3/5	Fostered teamwork & creativity, provided disaster preparation skills Enhance/reinforce hospital-employee disaster response & skills Based on specific vulnerability analysis & literature review
Exploration of nurses' perceptions on working together on high performance teams in the NICU & ED (Simmons & Sherwood, 2010)	Descriptive qualitative analysis Key variable: Nurses' perception of teamwork Research question: What are	Interview guide during focus groups with field notes Term "working together" used, as considered less specific phrase than "teamwork", with allowance	NICU RNs (n = 11) with average age 40-years-old & average of 14 years experience Three themes emerged: personal & professional	Revealed need for clear roles & responsibilities, respect & trust built over time between team members Recommendation to use TeamSTEPPS to increase

	nurses' descriptions of working together in the NICU and on trauma teams in the ED?	for broader range of responses	attributes, developing & maintaining relationships, & concurrence among members	teamwork behaviors,
	RNs (n = 19) in academic health center in TX			
Professional competencies from healthcare providers involved in disasters (Slepski, 2007)	Exploratory, descriptive pilot study Key variable: Background data on professional competencies Experienced healthcare providers (n = 200) attending disaster conferences in AL, LA, & MS	Anonymous survey constructed of demographic information & 3 open-ended question on emergency preparedness A 10-step hermeneutical approach of Streubert	Respondents: RNs 37%, MDs 24%, EMTs 10%, APRNs 5%, PAs 5%, DDSs 3%, LVNs 1.5%, all with average of 19.5 years experience Systematic exam of healthcare providers preparedness & response capabilities Respondents felt unprepared in expectations (n = 28), resources (n = 26), scope (n = 34), organization (n = 34), personal (n = 19), specific skills (n = 82) & systems issue (n = 126) Respondents (25%) with recommendation of training	Approximately 60% with prior disaster experience >85% in teams with previous mandated disaster training Training to include skills & transition from everyday practice

Note: AL = Alabama, APRNs = Advanced Practice Registered Nurses, CA = California, DDS = Doctor of Dental Science, ED = Emergency Department, EMTs = Emergency Medical Technicians, L&D = Labor and Delivery, LA = Louisiana, LVNs = Licensed Vocational Nurses, MD = Medical Doctor, MS = Mississippi, NICU = Neonatal Intensive Care Unit, PAs = Physician Assistants, RN = Registered Nurse, TeamSTEPPS = Team Strategies and Tools to Enhance Performance and Patient Safety, TX = Texas.