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SPECIAL FEATURES: EDUCATION

Use of an Emergency Preparedness Disaster Simulation With Undergraduate Nursing Students

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ABSTRACT This is a report of an educational strategy to prepare nursing students to respond to disasters. The strategy includes an emergency preparedness disaster simulation (EPDS) implemented in a school of nursing simulation lab using patient simulators, task trainer mannequins, and live actors. The EPDS immerses student groups into a "tornado ravaged assisted-living facility" where the principles of emergency preparedness can be employed. A total of 90 B.S.N. students participated in the EPDS in the final semester of their senior year. Student post-simulation survey responses were overwhelmingly positive, with mean scores of 4.65 (on a 5-point Likert scale) reported for the EPDS "increasing understanding of emergency preparedness" and "well organized." Mean scores were over 4.40 for "scenario believability, increasing knowledge base, increasing confidence in working in teams, ability to handle emergency preparedness situations and to work more effectively in hospital or clinic." The lowest mean score of 4.04 was for "prompting realistic expectations." Owing to the effectiveness of this educational strategy, the EPDS has been incorporated into the undergraduate curriculum.

Key words: disaster response, emergency preparedness, nursing education, public health nursing, simulation.

Recent reports from the American Association of Colleges of Nursing Baccalaureate Essentials (American Association of Colleges of Nursing, 2008) and Quality and Safety Education for Nurses (2011) challenge nursing faculty to develop teaching strategies based upon a set of core competencies. These competencies include educating students to act responsibly in the event of a disaster, practice collaboratively with other health care team members, and provide holistic care to clients from diverse cultural backgrounds. Also included is assisting students to shift their focus from individual patient care to caring for communities and at-risk populations. In order to address these concerns this University School of Nursing's curriculum introduces didactic content on the core public health principles of assessment, policy development, and assurance early in the student experience. The didactic content is followed by a variety of clinical experiences where students provide care to communities. While these educational strategies address the challenges of working collaboratively with other health care team members and providing holistic care to clients from diverse cultural backgrounds, they do not necessarily provide the proper environment to prepare students to respond in the event of

a disaster. Therefore, an emergency preparedness disaster simulation (EPDS) based upon the American Medical Association National Disaster Life Support Course (American Medical Association, 2007) is integrated into the nursing curriculum. The EPDS provides students with a tangible experience to care for communities in the event of a mass casualty incident.

Simulation allows for the acquisition of skills through repeated practice and management of emergency situations without risk to patients or to the students. Since disasters are inherently unpredictable, the opportunity to practice such an event in a simulated environment is ideal for initial exposure to management of a mass casualty incident. A hybrid of technology is used in the EPDS, including the use of human patient simulators, task trainers, and actors to create a realistic and chaotic environment within the School's simulation lab. The goal of the EPDS is to increase students' understanding and confidence in skill acquisition while providing nursing care during a disaster.

This article describes the use of an EPDS to prepare senior level baccalaureate nursing students to effectively respond to patients and communities encountering disasters. Student outcomes, including student attitudes regarding knowledge of emergency preparedness, confidence in ability to act effectively in the chaotic environment of a disaster, and confidence in working effectively as a team is discussed.

Background

According to the literature, training programs in emergency disaster preparedness are hospital-based (Nyamathi, King, Casillas, Gresham, & Mutere, 2007), in Schools of Public Health (Dembek, Iton, & Hansen, 2005; Orfaly, Biddinger, Burstein, & Leaning, 2005) and in a School of Medicine (Dembek et al., 2005). Common among each of these programs is the use of a table-top exercise for teaching, focusing on overall management and coordination rather than on the clinician/nurse role in patient care and triage during an emergency event. To identify criteria for developing bioterrorism training for hospital nurses, Nyamathi et al. (2007) compare a computerized program to a standard didactic program using a table-top exercise. Orfaly et al. (2005) uses a table-top exercise as part of a 2-day training session for graduate students in public health, medicine, government, arts, and sciences. Dembek et al. (2005) employ online webcast in conjunction with a table-top exercise for professional nurses, pharmacists, and physicians in an emergency disaster preparedness course for public health professionals, fire/emergency services, law enforcement, emergency management teams, and hospital administrators. Each of these programs were rated very highly by learner surveys.

The literature is very limited in describing the use of patient simulators to teach emergency disaster preparedness with student groups. Atlas et al. (2005) use a combination of standardized patients and patient simulators to assist medical students in recognizing clinical signs and symptoms of an anthrax attack. Ninety-three percent of the students reported the simulation exercise changed their awareness of respiratory disease transmission and 97% indicated they would alter their selection of respiratory protection when confronted with these signs and symptoms in the future.

Gillett et al. (2008) compare the value of patient simulators to live actor-patients for a mass casualty drill with physicians, residents, medical students, clerks, and paramedics in an emergency department (ED). By comparing the execution of critical actions between the simulator group versus the actor group; only one critical action was missed from both groups. The study reveals that simulators have equivalent results to live patients in prompting critical actions and simulating reality in mass casualty drills.

Literature describing the use of simulators to teach nursing students' emergency preparedness training is even further limited. Ireland, Kontzamanis, and Michel (2006) describe the development of a disaster preparedness program within a senior community-health nursing course. The program consists of a 3-hr didactic session, a 1-day symposium featuring experts in the field of emergency preparedness, and participation in an existing mock code disaster drill in the hospital. Students observe the nurse ED director who takes the role of the ED treatment leader and then either participates as a responder or a victim during the mock drill scenario. Participating in the scenario enables students to either apply the principles learned or to experience the process of being involved in a crisis.

Patient simulators are used as a teaching strategy for a variety of topics in undergraduate nursing

courses (Bearnson & Wiker, 2005; Henneman & Cunningham, 2005; Kaplan & Ura, 2010), graduate nursing courses (Scherer, Bruce, Graves, & Erdley, 2003), teams of nursing and medical students (Robertson et al., 2010), medical education at the resident or practitioner level (Lighthall et al., 2003; Reznek et al., 2003), and teams of practicing health care workers (Brett-Fleegler et al., 2008; Eppich, Adler, & McGaghie, 2006; Marsch et al., 2005; Weinstock et al., 2005). The use of patient simulators provides educators an effective strategy for teaching clinical decision making and allows more objective student evaluation through standardization of patients (Feingold, Calaluce, & Kallen, 2004; Flanagan, Nestel, & Joseph, 2004; Lee et al., 2003; Rauen, 2001).

Bremner, Aduddell, and Amason (2008), investigated the impact of simulation on the perception of confidence, comfort levels, and anxiety levels of nursing students entering their first clinical experience. In this study, the simulation group participates in simulation and lab before their first clinical day and the second group participates in lab only. The simulation group demonstrated a statistically significant decrease in stress levels before first time clinical experience. Feingold et al. (2004) examine the use of simulations with senior nursing students and determined that the simulation experience adequately tested clinical decision-making skills (80%), is valuable (69%), and enhances learning (75%). However, less than half believe the experience increased their confidence in the clinical setting or improves clinical competencies.

Emergency Preparedness Disaster Simulation

Preparation

All senior undergraduate nursing students participate in the simulation as part of the community-public health nursing course. The EPDS is designed to allow students to immerse themselves in a disaster event to increase knowledge and confidence in emergency response and management. The objectives of the EPDS are based upon the Center for Disease Control's Bioterrorism and Emergency Preparedness Competencies for Public Health Workers (Center for Disease Control & Prevention, 2001). These competencies are to: describe the public health role in emergency response; describe the chain of command in emergency response; identify and locate the agency emergency response plan; describe one's functional role in emergency response and demonstrate one's role in regular drills; demonstrate correct use of communication equipment; describe communication roles in emergency response; identify limits to own knowledge, skill, and authority; and indentify key system resources. Specifically pertaining to the EPDS, students are expected to identify nursing roles in an emergency situation; recognize the need for an emergency plan; practice triage and rapid assessment during a mass casualty incident; and demonstrate concepts of patient care using limited resources. In addition, the simulation's intent is to prepare students to respond to disasters, ensure optimal patient care and safety during such events, build the student's skills in team-work, clinical reasoning, critical thinking, effective communication, and to familiarize students with triage operations during a disaster.

Before the simulation, all students receive 10 hr of didactic content related to emergency preparedness, disaster planning, and response; emergency support functions at the community, state, and federal level; and triage procedures developed by the National Disaster Life Support Foundation (American Medical Association, 2007). Simulation is an integral part of the existing nursing curriculum, and all students come to the EPDS with previous experience in simulations related to mental health, acute care, mock codes, prioritization of care, and team training simulations.

Students participate in the emergency disaster preparedness scenario as a portion of a designated clinical day. Approximately 48 hr before their simulation time, students are given access to online content that includes their randomly assigned roles, as well as an example emergency preparedness case scenario with management techniques and community resources.

Roles

Team leader/incident commander for this team—Maintains awareness of overall situation, ensures all roles are filled, contacts outside agencies.

Second in command—Is primarily responsible to incident commander, and obtains necessary supplies and assists bedside nurse.

Triage staff nurse—Moves patients to safe zone and facilitates communication between areas.

Bedside assistant (*1–2 students*)—Remain with patient to provide direct nursing care as needed.

Each clinical group of 8–10 students is assigned a date and time for the EPDS. The clinical group is then subdivided into groups of 4–5 students to participate in the simulation scenario. The simulation is repeated for the remaining 4–5 students and is followed by the entire group of 10 participating in the debriefing session. Subsequent sessions are repeated throughout the semester to accommodate all 90 students.

Setting

The EPDS is conducted in the simulation laboratory within the Nursing School. The facility houses a "control room" where faculty can orchestrate the scenario through a one-way mirror and an audio-visual system. The simulation lab is staged to portray an assisted living nursing facility recently struck by a tornado. The scenario is purposefully created with a tornado as the cause of the disaster since tornados are typically encountered in this area of the country. Debris such as ceiling tiles, furniture, trash, and insulation is scattered throughout the room. One human patient simulator is placed on the floor in a haphazard fashion; a task trainer mannequin is also on the floor as the deceased patient, and a third patient is in a bed (live actor). As the scenario unfolds, additional "actors" enter the scene posing as the "worried well," media, and concerned bystanders interested in assisting.

Before entering the simulation room/tornado ravaged facility, students are instructed where an emergency bag with flashlights and minimal medical supplies is located in the event of failed electricity. Upon entering the room, lights flicker to simulate the failing electrical generator. "Patients" are crying out for help, and the room soon completely goes dark.

Scenario

The simulation begins with students receiving a synopsis of the scenario:

> At midnight, during wintertime, a "tornado watch" is initiated. Before you have been able to enact any of the regulations for emergency preparedness, the tornado strikes the one-story assisted living home where you and three to four other staff nurses are currently working.
> This facility houses 30 elderly residents with varying degrees of dependent care needs. About half of the residents are non-ambulatory; many require wheelchair transport or oxygen therapy. The roof has collapsed, causing multiple patient injuries. A fire has developed from a broken gas line that triggered the sprinkler system. At the section of the building that you are about to enter (the simulation room), the fire is currently extinguished.
> The building structure appears intact at this time. The generator is providing emergency lighting. Phone lines are down, but cell phones have service. You have no access to the TV, but your emergency radio is reporting massive damage in the metro area.

Students are told that they are playing the role of nurses currently working in this section of the assisted living facility/adjacent simulation room when the tornado strikes, indicating that they are the first responders to the scene. Students are further informed that although the fire is extinguished in this particular "unit," the status of the rest of the building may be compromised. In order to highlight the need for immediate action, students are given no more than 5 min for a "team huddle" to discuss their roles and expected plan of care. The actual simulation scenario runs for approximately 10–15 min. Students are expected to assume their assigned roles and to implement the measures they have learned regarding management of a mass casualty incident.

Ideal student responses

The following section describes the simulated scenario in detail and offers ideal student responses. The scenario was developed not with the assumption of student perfection in responses, but rather to expose students to the situation to increase understanding and acquisition of skills.

Upon entering the room, the lights flicker and eventually go out as the "facility's" emergency generator fails. Students retrieve flashlights from the emergency bag, and damages are assessed before proceeding further into the room. After surveying the immediate area, the "Team Leader" determines that the area appears structurally sound, and requests the "second in command" to make certain the oxygen and gas lines are off and to call 911. The team leader then calls out to patients to determine who is able to respond and who is ambulatory. All patients who are able to walk are immediately triaged to an area designated for "Minimally Injured

Victims." The next step is to assess and triage the remaining patients:

Patient #1 (simulator)—is lying under debris on the floor, crying for help. The patient is in severe pain with an open femur fracture. The bone is protruding, and the patient's pajamas are covered in blood. The student determines that the patient requires immediate care. After removing the debris, another student retrieves the supply bag to locate and apply a pressure dressing to minimize the bleeding. The students then determine if there are other injuries, control hypothermia caused by the sprinklers and splint the affected leg with materials that are improvised from the debris. If students demonstrate difficulty in managing care for this particular patient, a nursing faculty member enters the room posing as a nurse from another unit who comes to help as needed. During this time, students calmly comfort the patient who is in shock and bewildered by what is happening. Once the patient is stabilized, he is prepared for transfer with extra precautions to support the injured leg, head, and neck. A path is cleared of debris for the patient to be evacuated using sheets from the scene.

Patient #2 (simulator)—has no pulse, and a large metal rebar is penetrating his head. The assessment reveals the patient is deceased. The student must tag/mark this patient and cover the body to prevent further trauma to others of viewing the blood and the impalement. Students must then move on to assess others.

Patient #3 (faculty/actor)—is hysterical from the circumstances. The assessment reveals no abnormal physical findings or obvious injuries; therefore, treatment can be delayed. The patient is encouraged to remain calm and is moved to a safe location.

The atmosphere in the room becomes chaotic as aggressive media people arrive, followed by the arrival of family members and others who have learned of the situation and wish to assist. Students politely remove nonessential personnel from the area and remain with them or check on them frequently to allow essential care to be delivered. Throughout the simulation, the media continue to bang on the door demanding more information about casualties. Again, a student politely describes the current situation and provides updates in a timely fashion. The simulation ends when all patients have been appropriately triaged, categorized, and transferred.

Debriefing

The simulation concludes with a 30–45 min, faculty-led debriefing session. A standardized debriefing guide poses the following questions to the group:

- How did it feel going into the situation without lights, supplies, etc?
- What did you ASSESS as you entered the scene?
    - Who will be protected first (self, team, public, patients)?
    - What did you assess regarding the overall environmental safety?
- Were you organized/able to stay in role?
- How did it feel trying to rapidly assess and triage patients and to determine who would receive care first?
- How did it feel to "tag" and leave the deceased patient?
- How did you respond to the media or the families arriving to the scene?
- How do you think your future actions in the event of a disaster will be affected?The debriefing session focuses on the positive aspects of the student's performance and offers guidance for improvement. Tools for assessing and establishing a safe environment; strategies to implement ongoing control of the environment; appropriate means of contacting appropriate agencies for assistance; rapid and appropriate assessment and disaster triage; incident command processes; risk communication strategies with patients, media, and "worried well" or bystanders; and effective team function are discussed. Correct actions taken by the students are positively reinforced. Students are reminded of omitted actions, areas needing improvement, and reminders that the simulation is not intended to measure individual performance or skill proficiency. Academic course credit is earned for participation in the simulation and debriefing process, but the experience is not graded.

Evaluation

The University Institutional Review Board (IRB) determined that the EPDS was an educational

methodology that did not require IRB approval. Ninety students participated in the EPDS during their final semester of the B.S.N. program. The EPDS demographic and evaluation data were collected through self-reported, anonymous, pre- and postsimulation surveys. Students' ages ranged from 22 to 29 years old. Fifty percent had prior hospital experience as nurse technicians or nurse externs. Fourteen percent had training in Advanced Cardiac Life Support, and one student had training in Advanced Trauma Life Support. Ninety-three percent of the students rated previous simulation experiences as being significantly or moderately valuable with 6% indicating minimal value.

Results of the postsimulation survey of eight questions with responses based upon a 5-point Likert scale (5 = *strongly agree*, 4 = a*gree*, 3 = *no opinion*, 2 = *disagree*, 1 = *strongly disagree*) were overwhelmingly positive. Mean scores of 4.65 were reported for the EPDS "increasing understanding of emergency preparedness and the EPDS is well organized." All mean scores were over 4.40 for "scenario believability, increasing knowledge base, increasing confidence in working in teams, ability to handle emergency preparedness situations and to work more effectively in hospital or clinic." The lowest reported mean score of 4.04 was for "prompting realistic expectations." Evaluation outcomes are presented in Table 1. Students commented on what they liked the most and least about the simulation. Comments included:

> "I liked the scenarios because I can apply them to real life and use the information wherever we are in the community ... it was a good experience in dealing with difficult patients and the walking well ... it was very specific and prepared me to handle this situation if it may arise. I learned from my mistakes and feel better equipped ... the chaos was very realistic ... it is one thing to read the material on how to respond to a disaster, but it is another to actually experience it. I felt that it gave the idea of what a disaster would be like and helped to prepare me for future disasters in healthcare ... should be done on an even larger scale next year with more real people; would like to redo the simulation after the first try ..." "Better than other simulations because of the stuff on the floor ... much more realistic ... shocking ... overwhelming ... want to do it again ..."
>
> Negative comments expressed included, "It was difficult to hear where the voices were coming from and to know who was really supposed to be dead or just not speaking" "It was hard to stay in the role I was given."

Lessons Learned

The EPDS served as an ideal format to expose and prepare students to implement techniques used in disaster response and management. Typical of most simulation activities, faculty attempted to anticipate all student responses to the scenario, and yet student reactions become apparent only through the simulation experience itself. For example, some groups thought that the incident commander/team leader should completely assess the environment and injuries before calling for a 911 response. This led to a delayed response for assistance. During the debriefing, the need for immediate 911 assistance

TABLE 1. *Emergency Preparedness Disaster Simulation Evaluation*

Stimulation training	Evaluation outcomes: 5-point Likert scale (5 = *strongly agree*) Mean (n = 90)	Standard deviation
Well organized	4.65	.47
EPDS and debriefing increased	4.65	.57
Prepared me to work more effectively in hospital or clinic	4.49	.62
Increased knowledge base	4.51	.62
More confidence in ability to handle emergency preparedness situations	4.41	.65
More confidence in working effectively as a team	4.41	.65
Scenarios were believable	4.40	.65
Prompted realistic reactions	4.04	.90

Note. EPDS = Emergency Preparedness Disaster Simulation.

and subsequent phone call to give status updates was reviewed. Students also mentioned aloud that one of the patients was deceased. This in turn led to panic and hysteria from the other "patients." Strategies to defuse the situation were discussed in debriefing. Several students wanted to accept assistance from the "bystanders" instead of evacuating them to the safe area. These types of reactions would not have been evident through standard teaching strategies.

The EPDS was evaluated as a very positive experience. Virtually 95% of the students indicated they "agreed or strongly agreed" that the simulation increased knowledge and confidence in handling emergency preparedness events and in working in teams. The goal of the EPDS to increase students' disaster preparedness knowledge base, acquisition of skills in providing nursing care during a disaster without risk to patients or students, and confidence in management of a disaster, was met.

While some disaster training programs use standardized patients, using the hybrid of patient simulators and task trainer mannequins and actors is less time consuming and more cost effective than using standardized patients. Conducting the EPDS within the Nursing School as opposed to the hospital or ED allowed for students to immerse themselves at the point of contact of the emergency and to appreciate the need to be familiar with the institution's specific disaster plan. On-site training is also easier for faculty to implement. Although clinical faculty accompanied each student group, the EPDS continues to be time intensive for faculty, as additional people are required to serve in the various roles. No additional costs are involved, as the lab, simulator and supplies and for this simulation are already in place.

Students repeatedly commented that they enjoyed this simulation more than others due to the higher level of fidelity with the incorporation of "real" people in addition to assessing symptoms from the simulators. They felt that this led them to respond to the situation more realistically, and effectively allowed them to be "in the moment" of the emerging disaster. Faculty purposefully created a simulation with a very noisy and chaotic environment so that students were challenged to manage their response and care amidst the confusion that exists during a disaster event. Randomly assigned roles appeared to strengthen the skill level of all students, and maintaining these role assignments provided structure to the scenario progression and subsequent care. Based upon previous evaluations of earlier simulations, some initial strategies were altered. In earlier simulations minimal information was given to students before their arrival. Faculty found that this caused unnecessary student stress that negatively impacted learning.

Although the evaluation of this EPDS was informal, the positive student responses and faculty satisfaction with meeting the objectives led to this experience's being incorporated into the curriculum. The EPDS is an effective methodology to teach students to manage patients and communities encountering disasters. Future efforts may include masters nursing students and other health science students' participation in the simulation in order to strengthen team building and interdisciplinary community-focused care.

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