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# Designing a Disaster

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## ABSTRACT

A mass casualty simulation was developed and implemented for senior-level nursing students in a large baccalaureate program. This simulation was developed to introduce students to rapid triage in an interactive and immersive experience. The purpose of the simulation was to provide students with a realistic, hands-on experience in a safe environment. Unlike other similar exercises, all students participated in the health care provider role rather than as observers or victims. Didactic content regarding triage and a short video preceded the surprise simulated "bus crash." The element of surprise was used to create the chaos and confusion that often accompanies these incidents. Fifteen victims were comprised of static manikins, high-fidelity human patient simulators, and live actors with various injuries. The students worked in small groups and assigned each victim an appropriate Simple Triage and Rapid Treatment triage category on the basis of what they learned in lecture. Participating students performed well on their final examinations on questions covering the triage content they learned in this unit and feedback regarding the simulated experience was overwhelmingly positive. This simulation could be adapted for the education of other health care providers who may be involved in a future mass casualty incident.



## Key Words

Disaster, Mass casualty, Nursing students, Simulation, Triage


A mass casualty incident (MCI) involves any situation where emergency services are overwhelmed by the number and severity of people injured.[1] Even just 3 seriously injured victims can potentially overwhelm a small community hospital. The awareness of these incidents seems to have risen drastically since the September 11 twin tower devastation in 2001. In recent United States history, MCIs have been the result of a political rally shooting in Tucson, Arizona, tornadoes that devastated Joplin, Missouri, the Boston Marathon bombings, and the Sandy Hook Elementary tragedy, just to name a few. These examples provide evidence for the importance of training future nurses to understand the basic concepts of mass casualty situations. A general knowledge for all nurses is covered by the Nursing Emergency Preparedness Education Coalition competencies.[2] In addition, the American Nursing Association has called for the incorporation of disaster preparedness training for all nurses.[3] The purpose in creating an MCI simulation was to provide this initial education within a nursing program. Traditionally, MCI training in prelicensure nursing programs has been minimal.[4] As educators at the Ohio State University College of Nursing, the authors felt compelled to provide this training to their students in their high acuity (critical care) course in the last year of their baccalaureate program. Cognizant of the need for this content to be as realistic as possible, a surprise MCI simulation was incorporated into the course content. Among other aspects of MCI education, students would learn a basic triage protocol and then apply this training in a mock bus crash. The authors believed that applying this knowledge through simulation would help students better understand the dynamics and implications for various nursing foci.

This exercise was created by faculty and staff at the Ohio State University College of Nursing and built upon a well-established simulation program. The Ohio State University is one of the largest land grant universities in the nation and is located near downtown Columbus, a city with a population of 800,000. The Ohio State University College of Nursing celebrated its centennial in 2014 and boasts an enrollment of 1700 students among multiple undergraduate and graduate programs as well as more than 100 nursing faculty. The Technology Learning Complex (TLC), the nursing skills and simulation laboratory at the college, conducts more than 500 simulations per year. The MCI scenario was the first full-scale disaster simulation at the college.

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## MCI TRIAGE BACKGROUND

The act of triaging initially started during war times when it was vital to quickly assess wounded soldiers, stabilize them, and then make the decision to either return them to battle or transport them on to receive further medical care.[5] Military medicine has fine-tuned the process of MCI triage, but it is often difficult in civilian life to provide ample training because the frequency of MCI is much less likely to occur.[5] In an attempt to maintain high levels of expertise essential for effectively responding to MCIs, local emergency departments will conduct MCI simulations once or twice a year. The organization of a mass casualty simulation for a community takes a great deal of coordination and can involve all types of first responders, such as paramedics, firefighters, emergency medical technicians, ambulance and life flight personnel, police officers, or any off-duty medical personnel.[6,7] Hospitals and their staff must also be involved to fully simulate an MCI.

One can appreciate both the short- and long-term physical and psychiatric needs of a community following an MCI.[6,7] In addition to the immediate care of victims, family members may need assistance looking for lost loved ones or comforted as they mourn the death of a loved one. The relief effort following an MCI can include replacing lost clothes, finding temporary shelter, supplying food and clean water, in addition to offering immediate medical attention. Weeks to months afterward businesses may still be recovering from the impact of an MCI. Mental health interventions are often required for the immediate victims of these incidents but also are sometimes necessary for the rescue workers and medical staff themselves.[6,7]

Since the MCI simulation that was developed addressed only the immediate needs of the victims, it was incorporated into a critical care course. However, the simulation could be expanded into psychiatric and community nursing courses by addressing the additional long-term effects on health care workers and the community.

## MCI TRAINING IN NURSING EDUCATION

Since prelicensure nursing programs provide students a general knowledge of all nursing areas, the MCI triage simulation was not intended to develop competency. The purpose was to reinforce the didactic content. Any nurse could find themselves in the midst of an unexpected MCI no matter where they practice professionally; it makes sense for them to receive an overview of MCI response. With the unpredictable nature of these incidents, which may occur anytime and anywhere, mass casualty education is essential to any nursing curriculum.[8] Specifically, MCI concepts can easily be integrated into high-acuity, medical/surgical, community and psychiatric nursing courses.[9] For example, in a high-acuity course, where emphasis is given to critical care concepts and prioritization, there is an opportunity to discuss emergency department triage priorities in contrast to those of an MCI. Dialogue about the difference in approaches between the 2 settings to a patient's treatment priority can be thought-provoking. In the traditional hospital setting, priority is always given to the most acute or ill patient. In the MCI setting, the most severely injured patient will take up too many resources and must be left to die so that resources can be focused on those patients who have survivable injuries. The nursing student realizing that they must abandon an expectant victim and move onto one who has a chance of survival can be sobering. This is not a concept often discussed in nursing education but is a stark reality in MCI triage. In a community nursing course, students can explore the aspects of establishing an incident command center and securing the scene so that help is coordinated and effective. They can also discuss how nurses address the community impact of an MCI and how to garner and allocate necessary resources, such as an onsite morgue and temporary housing for displaced victims. Mass casualty incident education also has application in psychiatric nursing education by incorporating how to handle the "walking wounded" that often have more psychiatric symptoms than physical injuries.[9] Psychiatric nursing instructors can address nursing implications of posttraumatic stress disorder (PTSD) and anxiety-related issues that can go on for years following an MCI with their students. There is also a need for discussion about medical staff support and critical incident debriefing following a mass casualty by way of employee assistance programs.[6] For the purposes of our MCI simulation, the authors chose to focus on the immediate needs of the victims. In the future, we hope to expand into the community and psychiatric nursing courses.

## MCI EDUCATION UNIT DEVELOPMENT

Despite developing a lecture to overview emergency department nursing in a high-acuity nursing course, the instructor felt that it was appropriate to include related MCI content because some of the elements were the same. But unlike other clinical experiences that students receive while in the nursing program, there is no mass casualty clinical placement, and therefore MCI training will only be made available to a few nurses following graduation and intermittently depending on their chosen area to practice. A desire to make the content more than just words on a slide and with the widespread use of simulation as a valid learning tool, the instructor decided to pursue developing an MCI simulation for students. The next step was to approach the simulation laboratory about bringing the lecture content to life by creating the MCI experience.

The TLC, our clinical skills and simulation laboratory within our college of nursing, already had a well-established and successful simulation program, and the staff was immediately interested and eager to plan for the

experience and design our simulated disaster at the college. One TLC nurse, in particular, had previous experience with creating moulage (artificial wounds, bodily fluids, and simulated medical conditions to add realism) for mass casualty simulations within the community. These events had ranged from a pediatric mass casualty for emergency medical services (EMS) personnel, an annual plane crash simulation utilizing all local hospitals and EMS, simulations at the adjoining College of Medicine, and a shooting rampage simulation at a local school with special weapons and tactics and EMS, which was recorded for training purposes. These projects were sponsored by local EMS as well as the Department of Homeland Security.

Multiple planning meetings ensued to discuss the personnel, supply, and equipment resources needed. In addition to creating the list of injuries, it was necessary to purchase moulage supplies, find volunteer victims, and program the simulator to expire in a short period of time. The injuries and vital signs of all victims needed to encompass the range of injuries from walking wounded to expectant. We also coordinated the logistics of pulling off a surprise simulation for 80 students in that lasted less than 8 minutes. The whole operation needed to move systematically to provide a meaningful experience for students.

## MCI DIDACTIC CONTENT OVERVIEW

The emergency department/MCI unit didactic portion preceded directly before the simulation would start. This hour long lecture is given to a class of about 80 students in our traditional baccalaureate program in a high-acuity nursing course. The high-acuity course consisted of concepts regarding critical care and prioritization; some concepts included care of patients with acute respiratory distress syndrome, trauma injuries, gastrointestinal bleeding, acute myocardial infarction, and mechanical ventilation. Historically, these students were in their early to mid-20s and have no experience with emergency medicine or MCIs. When a student has a military background, they may be familiar with MCI triage concepts but needs to understand the nursing role. The lecture included an introduction to emergency department nursing and employing the use of the Emergency Severity Index[7] classification system, applying standing physician orders, and implementing nursing interventions in an organized and controlled setting. Therefore, the thought process from an emergency department triage standpoint is to care for the most urgent patient first, whereas the more minor patients wait for treatment as resources were plentiful.[7] This is in stark contrast to that of an MCI, where the thought is that the most critical victims may exhaust limited available resources that could be used to treat a greater number of less injured victims.[7] It was important to discuss with the students the shift in thinking from 1 patient as your priority to what is the greatest good for the greatest number.[7]

As part of this content, the class gets an overview of the 2 major triage systems used for MCI triage here in the United States. They were the Simple Triage and Rapid Treatment (START) method and the Sort, Assess, Life-Saving Interventions, Treatment and/or Transport (SALT) method.[5] It is also important to note that the START triage does not allow for decreasing patient acuity only for increasing patient acuity.[5] Although it is important to point out the differences between the 2 methods, it is also necessary to explain that the basic principles were the same. In planning our simulation, we chose to have students use the START method because it reinforced the community nursing content that students had already received. Following the explanation of the 2 systems, the faculty discussed the application of the START method, including the need for keeping each victim's assessment under 30 seconds. This quick assessment includes only respiratory rate, pulse, and mentation and allows the examiner to assess and care for as many victims as possible.[10] Since time and resources are a luxury during these events, efficiency is key in their management. The faculty discussed that frequent reevaluation of victims should be done when possible. At this point, it is important to also highlight that specific populations like children and senior citizens require different triage parameters and, for this reason, were excluded from our simulation.

## MCI SIMULATION OVERVIEW

Our first MCI simulation was conducted in the classroom with only 5 victims. Our victim list grew with each successive simulation, and our last experience incorporated 15 victims and had moved to the college of nursing lobby, the largest space in the building. We chose a bus crash as our setting, which would be introduced by the instructor at the onset of the drill by playing a 3-minute YouTube video reenacting first responders approaching the crash scene. This was our cue in the lobby to expect the students to arrive in minutes and was communicated via texting from someone standing just outside the classroom. The victims were positioned evenly throughout the lobby to accommodate the 80 students, and each victim was labeled using the North Atlantic Treaty Organization phonetic alphabet as trauma Alpha, Bravo, Charlie, Delta, Echo, and so forth. Our victim pool consisted of static manikins (expired victims), standardized patient actors (walking wounded victims), and 1 high-fidelity patient simulator (Table 1). We programmed the simulator to deteriorate over time so that each group would get a different assessment and by the end of the simulation that victim had expired. To obtain our standardized patient actors, we sent a mass e-mail to faculty and staff requesting volunteers. We received interest from many faculty and staff members. Many volunteers were excited to be included in the experience and get a chance to show off their acting skills. Some of them gave

**TABLE 1 Mass Casualty Incident Simulation Victim List[a]**

| Victim Name | Type of Injury | Pertinent Information | Triage Category |
|---|---|---|---|
| Trauma Alpha; high-fidelity simulator | Chest trauma; deteriorates to death | R-varies; P-varies; M-varies | Expectant |
| Trauma Bravo | Bruises and scrapes/glass fragments | R <30; P +; M A&O | Minor |
| Trauma Charlie; static manikin | No apparent injury | R none; P none; M none | Expectant |
| Trauma Delta | Metal in FA; bruises and scrapes—does not speak English | R <30; P +; M A&O | Delayed |
| Trauma Echo | Burn to FA; scrapes and bruises—does not speak English | R <30; P +; M A&O | Delayed |
| Trauma Foxtrot | Bruising and scrapes—metal thru hand | R <30; P +; M A&O | Delayed |
| Trauma GolfStatic manikin | Head injury; severed leg | R none; P none; M none | Expectant |
| Trauma Hotel | Scrapes and bruises | R <30; P +; M A&O | Minor |
| Trauma India | Scalp laceration—significant blood loss; pregnant | R >30; P +; M confused | Immediate |
| Trauma Juliet | R FA fracture; no pulse in R arm | R <30; P –; M A&O | Immediate |
| Trauma Kilo | Scrapes, bruises, burns to face | R <30; P +; M A&O | Immediate |
| Trauma Lima | Lacerations to hands—several deep | R <30; P +; M A&O | Delayed |
| Trauma Mike | Scrapes and bruises | R <30; P +; M A&O | Minor |
| Trauma November | Bruising and lacerations to head | R <30; P +; M confused | Immediate |
| Trauma Oscar | Fractured ankle | R <30; P +; M A&O | Delayed |

*Abbreviation: FA, forearm.*
*[a]Adapted from Mass Casualty Incident Program.*

quite impressive performances too. Our simulations incorporated a fog machine to create smoke, flashing emergency vehicle lights, and a siren recording aired over a loud speaker to add to the reality of a typical MCI scene. Preparations for the simulation began a couple of weeks prior, as we purchased things not usually associated with our previous simulations such as a fog machine for smoke, strobe lights for emergency vehicles, and a large roll of plastic to protect the lobby carpet from simulated blood stains. To divide students into responder groups, index cards, each with a North Atlantic Treaty Organization phonetic alphabet name corresponding to each victim, were handed to students. The students began with the victim who corresponded with their index card, as they left the classroom on their way to the MCI in the lobby. There were 5 to 6 students assigned to each victim at the beginning of the simulation and then every 30 seconds at the sound of a whistle blow by the instructor; they would advance to the next victim in alphabetical order. By following this process, all groups of students got a chance to triage all 15 victims over a 7- to 8-minute period, a much shorter time by comparison with any other simulation conducted in the past.

To add diversity to the experience, a non–English-speaking victim (German), a deaf victim, and a pregnant victim were incorporated into the simulation. These victims complicate the triage process for first responders, and the inexperienced students saw that firsthand. Many students mistakenly assessed the alert and oriented non–English-speaking victim as confused. Victim volunteers were oriented to their simulated symptoms, and some were told to wander around as they would in a real accident scene. To increase the realism of the simulation, we also included the bystander role as distractors who were trained to ask questions of the students disrupting their train of thought and escalating the chaos at the scene.

On the morning of the simulation, several hours were spent in the TLC applying moulage to the victims according to their injuries, whereas unsuspecting students listened to lecture across the hall. The victim conditions were crafted so that students would assign several victims to each of the following 4 triage categories: minor, delayed, immediate, and expectant. Various moulage materials were used to create the injuries. Theatrical makeup was used to add bruises, lacerations, and abrasions to

victims. Theatrical blood was added to the wounds to further increase realism. Wounds requiring large amounts of blood had intravenous tubing concealed in the wound, and a hidden large intravenous bag of blood flowed with the use of a pressure bag. Compound fractures were created using liquid latex, dried chicken bones, and special effect gel. Shards of fake glass were embedded in skin and hair along with other debris found at an accident scene. The placement of wounds and bruising were consistent with the mechanism of injury. For example, the bus driver would have had a seatbelt but the other passengers would not, so his or her injuries included bruising on the chest that had contact with the belt.

The students needed to quickly assess each victim's pulse, respirations, and mentation when deciding their triage category. Advanced moulage techniques were used to differentiate triage categories between 2 similar injuries. For example, a compound fracture for 1 victim was created to simulate a potential loss of limb due to decreased blood flow. This was accomplished by covering the distal pulse with a sheet of liquid latex or a sleeve of latex to create the absent pulse, which students could assess. In contrast, another victim with a compound fracture presented with a palpable distal pulse. A victim with a palpable distal pulse would fall into the delayed category, whereas a victim without a distal pulse would be in the immediate triage category.

Following the completion of rapid assessment of all 15 victims, the students reconvened in the classroom for a debriefing of the experience. The correct triage category for each victim was reviewed, and students evaluated their own performance. During debrief the students could discuss their feelings about abandoning the expectant victims and the helplessness one might experience trying to help so many without adequate resources. They also discussed the differing assessments they got of the 1 victim whose acuity's decreased as the simulation progressed (high-fidelity simulator). Further clarification about securing the scene, the impact of bystanders, stress management for first responders, and prolonged psychiatric needs for the population at large were also explored in the debriefing session.[9] This content was also covered in the community nursing course during the senior year. This exercise was a good opportunity to reinforcement the MCI content from a first responder role.

## EVALUATION

The simulation was an effective way to reinforce the MCI didactic content. Simulation as a teaching modality removes the risk that failure to act appropriately results in patient harm.[11] By participating in the mass casualty simulation, our nursing students could assume roles they might never have had a chance to do otherwise. It helped reinforce the importance of efficiency and quickly prioritizing patients by simply their respiration rate, pulse, and mental status.[10] The expectation of assessment within 30 seconds sounds easy in lecture, but the MCI simulation provided a real-life 30-second timer with the expectation to move to the next patient, ready or not. Since there is no way to predict who will actually be called to apply the training in a real situation, the more trained the nursing workforce in MCI triage, the better prepared we will be as a whole should such an unfortunate event occur.[7]

The high-acuity final examination included 5 questions related to MCI content. The students were given the algorithm and a victim description for each of the 4 categories. After reviewing the test results, it was noted that at least 95% of the class answered all 5 questions correctly.

As we completed the MCI simulations over the years, we have come to realize some challenges to this type of large-scale simulation. For instance, making a bus crash scene come to life would have been more realistic outside. Debris could have been scattered around the scene, and victims could have been spaced farther apart; however, we would have risked damaging an expensive high-fidelity simulator in any inclement weather, and moving the scene quickly to an alternative indoor location would have been difficult. Another challenge we found was that students had problems breaking from the habit of completing head to toe assessments during the simulation, as they were used to doing in other clinical experiences. This sometimes caused them to take longer than the 30 seconds allotted during the first 5 to 10 victims, although they usually got the idea by their 15th victim. Also, although we felt that our plan to rotate the students was sufficient to keep them on track, some chaos prevailed when the 80 students tried to figure out where they were supposed to be but this is typical of any mass casualty scene—initially chaos is everywhere. For 1 of our simulations, we invited local EMS who parked emergency vehicles outside, which added to the realism, and students got to report off on their last victims. Local news stations covered the story, which was exciting to all involved. We have realized that there is a large gap of knowledge between our prelicensure nursing students and seasoned first responders. It would have been more effective to incorporate their prelicensure counterparts, and we hope that collaboration will be made possible in the future. Our college has recently transitioned from a quarter to a semester system, and we look forward to reenacting the MCI simulation in a new Emergency Department Nursing elective course soon.

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