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Educational Innovation

Enhancing nursing students' capacity to respond to extreme weather events using an innovative tabletop simulation activity

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ABSTRACT

Background: The increasing frequency and intensity of climate change-driven extreme weather presents challenges to healthcare systems globally. Nurses, the largest healthcare workforce, often lead disaster responses but may lack the skills and knowledge needed to respond effectively. Accessible, innovative educational approaches would improve workforce readiness.
Innovation: We developed a tabletop simulation to enhance nursing students' understanding of climate-induced extreme weather events and response strategies. Six simulation scenarios were derived from interviews with nurses who have first-hand experiences in such events.
Results: Informal feedback indicated that students believed the simulation enhanced their critical thinking, decision making, collaboration, teamwork, preparedness, and adaptability, in crisis situations. It also prompted reflection on the emotional and ethical considerations of disaster response.
Implications: This cost-effective, low-stakes simulation enhances critical thinking, decision-making and teamwork skills, contributing to individual and system-wide resilience in response to climate-induced challenges.
Conclusion: Tabletop simulations offer a valuable tool for prelicensure education and professional development, immersing learners in realistic, unpredictable scenarios that enhance emergency preparedness.

Background

The World Health Organization [WHO] has described climate change as the greatest threat to public health in the 21st Century (2015). Across the world, communities are already feeling the effects of a warming planet with more frequent and intense heatwaves, unprecedented droughts, hurricanes, fires and floods. Illness, injury and death related to environmental disasters represent just a few of the impacts of climate change on people's health and well-being (Leyva et al., 2017). Extreme weather events disproportionally affect marginalized communities and vulnerable populations (World Meteorological Organization, 2023; DCCEEW, 2021; Ebi et al., 2021).

Climate related extreme weather events disrupt service provision, put a significant strain on healthcare resources, and demand a rapid, coordinated response to ensure continuity of care and patient safety (Ward et al., 2024). Nurses are often at the forefront of these crises, and their preparedness and leadership skills are critical in responding to the needs of individuals and communities. The International Council of Nurses states that "Nurses can make a powerful contribution to both mitigate climate change and to support people and communities to adapt to its impacts. Leadership from nurses to build climate resilient healthcare systems is critical."

In the context of the Anthropocene, where human activity is having a profound impact on the planet, nurses are increasingly working in nontraditional roles that extend beyond routine patient care (Richards et al., 2023). This highlights the need for innovative educational approaches that not only equip learners with the ability to respond to disaster situations, but also foster skills in leadership, interdisciplinary communication and collaboration (Martin et al., 2024). However, many nursing students are not provided with adequate education on how to respond to these types of crisis situations, leaving the future nursing workforce ill-prepared to effectively manage the unique challenges they are likely to encounter (Tutticci et al., 2024).

One strategy for addressing these types of unpredictable situations is simulation-based learning (SBL) (World Health Organization, 2013), a teaching and learning approach that has become ubiquitous

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in healthcare education (Tasantab et al., 2023; Ma et al., 2021). SBL can enhance decision-making, interdisciplinary teamwork and leadership skills while preparing participants to respond to emergent and critical situations effectively (INACSL Standards Committee, 2021). Aligning SBL scenarios with real-world situations such as extreme weather events, contextualizes the challenges nurses face, enhances their ability to apply theoretical knowledge in practical, high-pressure situations (Cant & Cooper, 2017), and profoundly impacts cognitive and affective learning (Ozdemir & Dinc, 2022).

While evaluations of the impact of SBL simulations have been overwhelmingly positive (Cant & Cooper, 2017), much of the literature has described high fidelity immersive simulations and increasingly hi-tech virtual reality experiences (INACSL Standards Committee, 2021). The motivation to provide rich learning experiences has to be tempered by contemporary challenges related to contracting budgets, overfull curricula, time constraints and increasing academic workloads (McCarthy, 2023). There is a need to find a balance between the cost and effectiveness of SBL when designing impactful learning experiences that can be consistently deployed across contexts and for different cohorts.

This paper describes the impetus for, design and implementation of an innovative cost-effective extreme weather event tabletop simulation. Tabletop simulations provide low stakes educational activities that allow participants to rehearse their roles and responsibilities during an unpredictable incident, solve emergent problems and discuss the actions they would take individually and collectively in response to one or more scenarios (Frégeau et al., 2020; Sanko et al., 2020). These activities create opportunities for participants to work through multiple options to identify possible solutions.

Tabletop simulations as the name implies, are played out around a table, with participants working in small groups responding to written or verbal prompts related to the unfolding scenario. The atmosphere is purposefully informal, noncompetitive, collegial and exploratory. Tabletop simulations are used to prepare for different types of crises, with cybersecurity and disaster recovery common areas of focus (Brydges et al., 2021). However, there has been a growing interest in the use of tabletop simulations in healthcare education over recent years (Frégeau et al., 2020).

Development of the Extreme Weather Event Tabletop Simulation

In response to the issues outlined previously, we developed an innovative tabletop simulation, specifically focused on nursing responses to extreme weather events impacting clinical and community contexts. This activity was designed to bridge the gap between theoretical knowledge and practical application, ensuring future nurses are better equipped to respond to the complex challenges posed by climate-induced disasters. The simulation scenarios were informed by contemporary literature and after conducting interviews with nurses and midwives who had first-hand experiences in responding to extreme weather events (Planetary Healthcare, 2024). This allowed us to integrate real-world challenges into the simulation, ensuring it reflected the unpredictability and intensity of such events.

The development process also involved brainstorming sessions to refine the structure of the scenarios. Drawing on the expertise of experienced nursing academics with a background in planetary health, we created a series of simulation scenarios that immerse participants in step-by-step unfolding climate disasters. The scenarios focus on floods, heatwaves, bush/wildfires, cyclones/hurricanes and thunderstorms and the duration of the simulation is 45-60 minutes. The objectives of the simulation are to enable participants to:

- Explore how extreme weather events can affect healthcare infrastructure, resources and patient care.
- Develop skills in critical thinking, assessment, prioritization and decision-making while in challenging situations.
- Adapt teamwork and communication skills to ensure a coordinated and efficient response during crises.
- Educate colleagues, healthcare organizations and communities on preparing for extreme weather events.
- Reflect on their experiences, identify key lessons learned, and apply these insights to real-world situations.

Implementation of the Extreme Weather Event Tabletop Simulation

After explaining the learning objectives, the facilitator provides an overview of the session including the impact of extreme weather events and nurses' role in these types of situations. Students are then organized into 6 groups of 4 to 6 students; and each group is given a simulation pack that focuses on a specific extreme weather event. Students are instructed to turn over the first card in the pack which provides the initial information about the crisis situation and a number of prompt questions (see below):

> *A category 5 cyclone has struck a remote community with unprecedented force. It is causing widespread damage, with many homes and public facilities destroyed. Essential services have been disrupted, and both power and communication lines are down. Many people are injured or in shock, complicating the response efforts. At 4pm you are asked to set up and coordinate the evacuation center at the town's basketball stadium.*

- How will you quickly set up the basketball stadium to accommodate the needs of the evacuees?
- Who can you ask to help you prepare?
- What do you anticipate will be the priority needs over coming hours?

The facilitator guides students in discussing how they would respond to the unfolding situation described. They are reminded to think broadly and consider more than the immediate healthcare concerns presented. The focus should be on coordination of the emergency response, as well as prioritization, and communication. Students are assured that, while they may not feel they have the experience to manage the situations presented, they may in fact be the most experienced person in a disaster situation and others will turn to them for advice—the simulation is about being resourceful and creative.

After approximately ten minutes, the facilitator instructs students to turn over the next card which builds on the previous information and allows students to see how health care priorities may change over time and in response to both the extreme event and the needs of the people impacted (see below):

> *It is now late into the night. More than a hundred people are at the evacuation center. You've just been told that the Riverside Caravan Park has been so badly affected by the cyclone that its 60 residents also need to come to the evacuation center. You are aware that the park's residents include a number of vulnerable groups—people with unstable housing, some who have recently been released from prison, people who are recovering from substance abuse issues, as well as women and children escaping domestic violence. Many of the people at the evacuation center have lacerations and other injuries. Some are also showing signs of psychological trauma and emotional distress.*

- How can you quickly determine and prioritize the needs of the anyone who is injured or unwell?
- How can you access necessary medications and supplies for treating injuries and managing chronic conditions?

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- Who can you ask to help you assess and care for those needing attention?
- How will you ensure the safety and security of the evacuees, particularly those who are vulnerable?
- How will you identify and meet the evacuee's immediate needs for secure shelter, food and water?

The simulation continues in this manner, with students being instructed to turn over new cards that describe the unfolding scenario every 5-10 minutes. The final stage (before the debrief) in the simulation creates the opportunity for students to reflect on and discuss the social/emotional/ and mental health impacts of extreme weather events, and the role that nurses can have in the development of community awareness and resilience.

In the debrief, students are asked to discuss how they felt about the simulation experience and what they learnt. To further extend on the learning experience (time permitting), each group gives a brief outline of their simulation scenario, the main challenges encountered and the strategies used to address them. A future focused discussion or assessment activity for advanced learners is an exploration of the simulation using Perlin's "5S" framework (Perlin, 2020):

- *Staff = available personnel (healthcare staff, local authorities, emergency workers and community members)*—Discuss staff or human resources called on during the simulation? Do you have any advice with regards to planning staffing and support for future extreme weather events?
- *Stuff = supplies and equipment*—What did you have? What did you need? Do you have any advice with regards to planning supplies and equipment for future extreme weather events?
- *Space = facilities and infrastructure*—How did you manage with what you had? What were the challenges? Do you have any advice with regards to planning facilities and infrastructure for future extreme weather events?
- *Systems = policies and processes* (when appropriate/available)—Did you use any policies, processes, guidelines etc. in the simulation? Would they have been helpful? Do you have any advice for planning with regards to policies and processes for future extreme weather events?
- *Security = safety and support (yours and others)*—Were there any risks to yours or other people's safety or security? How did you manage this? Do you have any advice for planning with regards to safety and security for future extreme weather events?

This tabletop simulation activity provides a safe introduction to the unpredictability and complexity associated with healthcare responses during extreme events. It encourages the development of higher-order thinking skills along with the application of theoretical concepts. The flexibility of tabletop simulations means that this approach can be adapted to a variety of educational settings and across a wide range of student experiences. The potential to build complexity into subsequent scenarios also ensures student learning can be scaffolded to progressively build confidence in the development and application of knowledge and skills.

What is particularly relevant to this tabletop simulation is that it encourages a deep understanding of the unique challenges associated with the increasing frequency and severity of extreme weather events (World Health Organization, 2024). It also provides a stimulus for reflection and discussions related to climate change, interdisciplinary responses and the way that extreme events can shape and reshape healthcare roles.

Results

To assess the quality and effectiveness of the table top simulation and to refine it for future use, students were invited to provide informal evaluative feedback with regards to the 4 open-ended questions below:

1. What is the most significant thing you have learnt from this simulation activity?
2. In what way did the simulation enhance your understanding of emergency response coordination during extreme weather events?
3. What aspects of the simulation was most challenging?
4. What recommendations do you have for improving this simulation?

The student feedback was anonymous and captured using a RedCap survey software. it was then downloaded into an Excel spreadsheet and categorized into recurring themes. Although ethical approval was not required for this quality project, ethical processes were followed during the entire evaluation process.

Overall, students' feedback indicated that the tabletop simulation was a valuable learning experience that enhanced their ability to think critically, communicate effectively, and make informed decisions under pressure.

Critical Thinking and Decision Making

Participants highlighted the importance of prioritization and critical thinking in high-stress, resource limited scenarios. Many students noted the value of triage skills and the ability to think creatively when traditional resources or protocols were unavailable. One student stated, *"This activity helped me learn how to manage limited resources and use them in the best way possible."* Additional feedback reinforced the impact of the activity on students' higher order thinking:

- *"It got us thinking about potential scenarios in the future where thinking outside the box will be required."*
- *"It allowed me to deep dive into the ramifications of making decisions"*

Collaboration and Teamwork

Students feedback highlighted an awareness of the need for collaboration with others to develop and implement solutions. They also found value in leveraging the diverse skills and perspectives of their peers. As one student noted, "*Teamwork makes the dream work; it was helpful to see how others approached challenging scenarios.*"

Additionally, students recognized that "*emergency response management is a team effort,*" highlighting their understanding of coordinated responses in disaster situations.

Preparedness and Adaptability

Many students reflected on the unpredictability of climate-related disasters and the need to remain flexible and prepared. Their feedback highlighted the importance of contingency planning, with one stating, "*Anything could happen in today's world, and this simulation taught us to be ready for the unexpected.*"

Emotional and Ethical Challenges

Students identified the emotional and ethical difficulties associated with decision-making in crisis situations, particularly when

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resources are limited. They also commented on the challenge of needing to make decisions in rapidly unfolding situations. One student noted, "*It was emotionally confronting to prioritize care when there were so many competing needs.*" Another added: "*Deciding who prioritize in an emergency was stressful because there is no perfect solution—every choice has consequences.*"

The informal feedback provided by students demonstrated the educational value of the simulation in fostering practical, cognitive, and emotional competencies in preparation for responding to extreme weather events.

Future Directions, Recommendations, and Limitations

The implementation of cost-effective tabletop simulations presents a unique opportunity to enhance meaningful and memorable student learning. This approach is particularly useful as it is adaptable to various educational settings and modalities, including face-to-face, online, synchronous and asynchronous environments. The relative simplicity of this simulation allows for widespread replication, enabling educators to tailor the experience to different cohorts. Lastly, these types of educational interventions can foster deep engagement and critical thinking among nursing students, demonstrating that impactful learning does not always require complex or expensive equipment (Khasawneh et al., 2021).

As the effects of climate change intensify, it has become increasingly important to equip nursing students with the types of skills, such as critical thinking, decision-making, leadership and teamwork, that are vital for effective crisis responses (Rachmawati et al., 2022; Richards et al., 2023). Expanding the simulation to encompass a broader array of scenarios would enhance the preparedness of nursing students for other real-world challenges associated with climate change.

To maximize the educational benefits of this learning activity, it is recommended that these simulations be introduced early in the nursing program. This early integration allows students to develop critical competencies progressively throughout their educational program. Additionally, fostering interdisciplinary collaboration within these simulations would assist nursing students to appreciate the importance of teamwork to crisis management (Rachmawati et al., 2022).

Despite the promising potential of tabletop simulations, one key limitation must be acknowledged. The effectiveness of these types of simulations is dependent on the presence of skilled facilitators who can guide students through the scenarios and provide constructive feedback (Luo et al., 2021). Secondly, although the tabletop simulation provided a meaningful learning experience, exposure to an immersive real-time disaster simulation would be a valuable follow-up learning activity to apply and imbed learning in a practical setting.

Conclusion

The innovative tabletop simulation described in this paper offers a valuable and cost-effective addition to nursing education, particularly in preparing nurses for the growing challenges associated with climate-induced extreme weather events. Its low tech, high-impact design ensures accessibility across diverse learning contexts and for students of different levels.

As climate change continues to amplify the frequency and severity of extreme weather events, integrating these types of learning activities into nursing curricula is essential for building a resilient healthcare workforce. Whilst this simulation cannot fully replicate the unpredictability of real-world situations, its adaptability and reflective approach offer significant potential for improving preparedness at every stage of nursing education.

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Ethics Approval

Ethics approval was not required for this educational activity.

Declaration of Competing Interest

There are no conflicts of interest undertaking this research.

CRediT authorship contribution statement

Tracy Levett-Jones: Writing – review & editing, Writing – original draft, Formal analysis, Data curation, Conceptualization. **Chris Zehntner:** Writing – review & editing, Writing – original draft, Formal analysis. **Aletha Ward:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

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Further reading

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