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LEKCIJE IZ SIMULACIONIH VEŽBI ODGOVORA NA KATASTROFE SA MASOVNIM PRILIVOM PACIJENATA

LESSONS FROM SURGE DISASTER RESPONSE SIMULATION ACTIVITIES

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Summary:

Purpose: Emergency Departments (ED) play a sentinel role in disaster responses, from decontamination and triage to stabilisation of patients, while continuing to provide routine medical care for existing and new patients. However, the low frequency of disasters and patient surge and major internal catastrophes limits preparedness among emergency personnel. **Aims:** The aims of this study were to report how Patient Surge Disaster Response simulation activities impacted interagency preparedness and informed future planning of disaster preparedness training. **Methods:** We developed and delivered two tabletop ED reception activities and one in-person chemical, biological, radiation (CBR) decontamination scenario for a multi-disciplinary group of clinicians and senior administrators. Data were collected from participants and faculty via pre- and post-questionnaires and notes from debriefings and verbal feedback from faculty. Descriptive statistics were used to summarize numerical data and thematic analysis for textual data. **Results:** From around 100 participants, the pre- and post-questionnaires were completed by 73 (pre-PSDR) and 56 (post-PSDR). Participant professions in the pre-intervention and post-intervention questionnaires were similar. Participants' self-assessment demonstrated significant improvements in understanding and identifying roles, teamwork and confidence in disaster responses ($p < 0.001$ for all outcomes). The key theme from qualitative data was that the capability of the response will influence future preparedness activities, including staff training, interdisciplinary collaboration, and equipment maintenance. **Conclusion:** Inter-agency simulation learning events were associated with improved confidence in preparedness and team response. These findings indicate the need for regular activities to ensure frontline staff are familiar with and prepared for disaster responses.

Key words: Emergency medicine, disaster, wounds and injuries, simulation, tabletop disaster training

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INTRODUCTION

Emergency departments (EDs) are at the forefront of acute and chronic care of patients. Emergency clinicians are expected to meet the community's needs and by doing so, are faced with the uncertainty of patients' presentations. Absorbing the intense emotions and difficult tasks of risk stratification and resuscitation as an emergency team of experts is one of its core competencies, and regular exposure to such workload contributes to maintenance of knowledge, skills and expertise. In the setting of disasters, EDs serve multiple roles. These include decontamination and triage to stabilisation and treatment of victims, all while continuing to provide routine medical care to existing and other new patients.

In Victoria, hospital emergency response plans to disasters must comply with the State Emergency Management Plan (SEMP)[1] and the Health Emergency Sub Plan (SHERP)[2]. These plans are aimed at ensuring capacity to respond is present and that health organisations have strategic and operational plans to prepare, mitigate, respond and recover from significant 'all hazard' emergency risks. An example of recommendations to maintain competency is that in Australia's largest adult major trauma hospital, all wards and departments must undertake a practical emergency exercise training annually to test staff response to an emergency event.

The low frequency of disasters and patient surge and major internal catastrophes limit our ability to test our preparedness and expertise and to demonstrate capacity that emergency code performance is integrated in emergency medicine practice[3]. Preparedness presents hypothetically the most controlled and theoretically coordinated phase in disaster management, which will ensure balance in activation and response management. Furthermore, it has the potential to increase resilience of the system and minimise event consequence, while ensuring expected standard of patient centered care.

Less frequently activated emergency response codes require 'Phase one escalation' prior to activation of a formal declaration of external disaster and therefore are managed within the department and without need to significantly change day to day practices or disrupt "business as usual."

The aims of this study were to report how Patient Surge Disaster Response (PSDR) simulation activities impacted interagency preparedness and informed future planning with disaster preparedness training.

METHODS

Setting/program: This study took place at a major Melbourne tertiary hospital (one of two adult major trauma referral centers in the state of Victoria) and a smaller community hospital with an ED and operating theatres, and no ability to admit patients requiring critical care on site. Neither hospital has admitting capacity for critically injured patients under 16 years of age.

Intervention: As part of the PSDR program, during the study period February to November 2023, the PSDR program team completed three sessions of experiential learning involving interdisciplinary, interhospital and interagency collaboration with all sectors involved in planning, preparation, participating facilitation reflection, and follow up of the outcomes. These simulations included the following scenarios:

1. Surge of trauma and burns patients in setting of suspected terrorist act on multiple urban sites (conducted at the major tertiary hospital).

2. Surge of heat-related and trauma-related presentations in setting of extreme heat conditions (conducted at the community hospital)

3. Surge of chemically contaminated patients following incidental chemical spill at a local warehouse, requiring mass chemical, biological, radiation (CBR) decontamination (conducted at the Alfred Emergency and Trauma Centre).

The first two scenarios were implemented as tabletop modalities, while the third was conducted as a real time scenario with staff portraying casualties. Each activity was 3 hours and included specific phases of briefing, scenario, pause and discuss, follow up and reflections.

During the scenario, participants were simulated to have taken over the handover of ED and familiarised themselves with existing patients. Patients from the incident were simulated to have arrived in combination with usual everyday patients. Participants were expected to recognise the need to identify sentinel presentations from the incident, and recognise and escalate potential impending surge that could overwhelm services. The activities

progressed to strategies to create capacity, triage and treat incoming patients.

Senior representatives from each agency or stakeholder department were invited to participate in preparation of the program and each scenario (Box 1). They contributed with insight in needs assessment as well as to ensure that each discipline has defined appropriate objectives and measured outcomes that align with current specific roles of the discipline. Some of them participated as embedded faculty in person or online or as expert faculty during the simulation and debrief [4, 5].

Box 1. Participants External to ED

Agency /department	Members
Hospital Leadership	Executive Service Director Department Director
Ambulance Victoria	Senior Response Coordinator
Monash Children's Hospital	Pediatrician/Neonatologist Pediatrics Emergency Department Admitting Officer
Alfred ICU	Fellow ICU Nurse Unit Manager
Radiology	Radiographers Radiology Registrar
Anesthetics	Anesthetist in charge
Disaster preparedness	Coordinator

After the completion of the session, a structured debrief was conducted, where all participants as well as leadership and expert members were invited to comment and provide their view regarding lessons learned, revealed gaps in knowledge, system and equipment, and propose future actions to achieve readiness to respond in the future [4,5]. Quantitative feedback from participants was collected on a 5-point Likert scale. Feedback was collected at the end of the exercise and therefore provided a global measure of the quality of scenarios, exercise and debrief. Furthermore, a follow-up email was sent to participants and faculty expressing gratitude for their involvement and invited further feedback [6].

Statistical analysis: Baseline roles of participants were summarized using counts and proportions and compared using Fisher's exact test. Confidence in self-assessment domains were collected using a 5-point ordinal scale (Figure 2) and summarized using medians and

interquartile range. Changes were assessed using Wilcoxon Rank Sum test. A p-value of <0.05 was defined to be statistically significant. All analyses were conducted using Stata v 18.0 (College Stations, TX, USA).

Thematic analysis was utilised to extract themes from qualitative data. The analysis followed a systematic and iterative process, allowing for the identification, development, and refinement of the themes. The study protocol was reviewed by The Alfred Hospital Human Research and Ethics Committee and approved as a quality improvement study. The requirement to seek informed consent from participants was waived.

RESULTS

An estimate of around 100 participants attended, and the pre- and post-questionnaire was completed by 73 (pre-intervention) and 56 (post-intervention). Majority of participants (n=60) were medical and nursing staff. Participant role within the organisation, and their role in the disaster exercise, together with their evaluation of the program are listed in Table 1. All responses for self-assessment demonstrated significant improvements (p<0.001 for all questions) and are illustrated in Figure 2.

Table 1. Roles and feedback

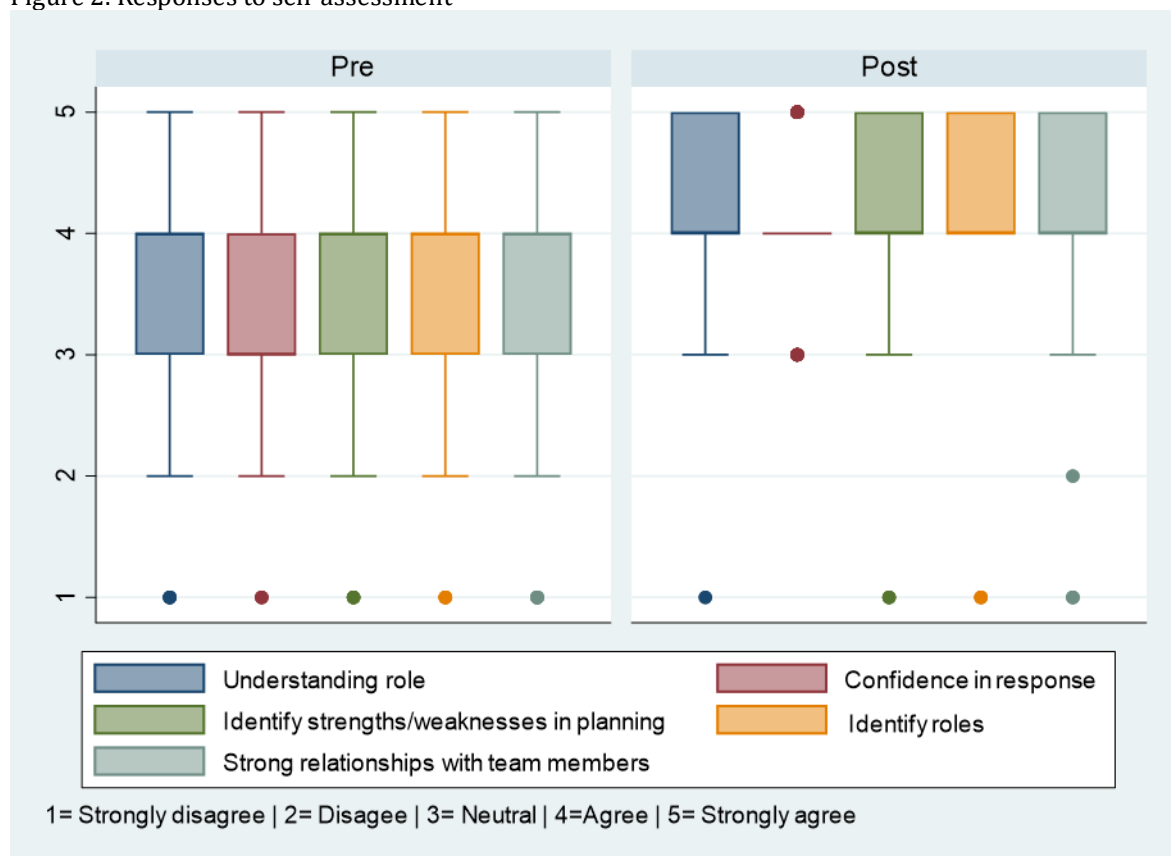
	Pre N=73	Post N=56	p- value
Role in organisation:			0.99
Allied Health	3	2	
Nurse	30	26	
Clerical	1	1	
Consultant	15	9	
Manager	0	1	
Nurse Practitioner	1	1	
Pharmacist	1	1	
Registrar or Fellow	17	11	
Radiology	5	4	
Role in exercise			0.23
Faculty	24	18	
Observer	4	0	
Participant	45	38	
Feedback*			
Scenario plausible & realistic		4 (4-5)	
Generation of positive discussion		5 (4-5)	
Exercise improved disaster preparedness		4 (4-5)	
Debriefing contributed to learning		5 (4-5)	
Recommend exercise to others		5 (4-5)	

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*Median scores (Inter-quartile range) on 5-point Likert scale of Strongly disagree (1) to Strongly agree (5). Responses to self-assessment

agree (5)



Eight themes were identified from the combined qualitative data sources.

Notification and escalation: Timely recognition and escalation of incidents are critical for effective emergency response. In all scenarios, the Emergency Department (ED) leadership and hospital coordination team were identified as the primary contacts for operational support, resource management, and logistics. The sudden unavailability of acute and critical care services can significantly impact departments not directly involved in the immediate response, such as elective surgery and obstetrics. Therefore, broader notification measures are necessary to ensure hospital-wide preparedness.

Patient registration and Surge management: Pre-established patient registration strategies proved essential in managing surges efficiently. The use of pre-registered patient identifiers facilitated a smoother intake process. Additionally, leadership presence during training sessions provided valuable guidance, ensuring staff readiness and reinforcing effective workflow practices.

Resourcing and floor management: The high cognitive demand on nursing and medical

leadership during a crisis requires structured delegation. Establishing non-clinical leadership roles to oversee coordination allows clinical staff to focus on patient care. Effective communication, delegation, and structured command and control systems help mitigate task fixation and ensure efficient management of resources on the floor.

Pre-hospital considerations: Disruptions in prehospital emergency workflows can lead to unexpected patient arrivals with limited notification, increasing pressure on receiving teams. The absence of adequate ambulance transport may result in critically ill patients, particularly children, arriving via bystander or carer transport, adding to the ED workload. Rapid offloading strategies must be coupled with early stabilization measures to manage these cases effectively.

Clinical management: While patient management generally follows standard care protocols, crisis situations require heightened oversight and coordination from senior clinicians. The interdisciplinary critical care approach plays a key role in ensuring timely and

high-quality treatment, particularly in resource-limited conditions.

Role of Clinical pharmacist: Clinical pharmacists are integral to medication management in both routine and surge scenarios. Their expertise in the safe distribution and documentation of medications is invaluable. Given their crucial role in maintaining medication safety, clinical pharmacists should be actively involved in surge response training and planning.

Patient flow disposition from ED: Facilitating early collaboration with interdisciplinary teams is essential for effective patient disposition from the ED. Although interhospital transfers may be delayed due to limited acute transport availability, remote specialist input via phone, online consultation, or in-person collaboration has proven beneficial in optimizing patient care pathways.

CBR considerations: While prehospital agencies typically decontaminate and stabilize CBR-exposed patients before transfer, self-presenting patients from nearby incidents may pose significant risks to healthcare providers. Given the high-risk nature of such cases, ongoing interdisciplinary training and equipment maintenance are necessary to ensure safe decontamination processes. Reception and initial management of critically ill patients in hot zones require well-defined protocols for communication, medication distribution, and stabilization. Communication barriers—such as PPE constraints, noise, physical distance, and wet environments—necessitate practical, field-tested solutions that are yet to be fully established.

DISCUSSION

Following participation in a disaster preparedness program, participants self-reported increase in knowledge, skills and confidence. This is likely the result of exposure and the constructive nature of experiential learning and soundly structured exercises with appropriately defined objectives and interdisciplinary and interagency expert faculty [4, 7]. The opportunity to expose professional identity and role in such events contributed to decrease in uncertainty and ensures that system strategic planning sustains the application test and reveal balance between capacity versus capability [8].

These findings are consistent with previous evaluation of simulation-based disaster training exercises. Tabletop exercises for disaster planning had been previously shown to be

feasible and effective [8]. In addition, they have been associated with statistically significant increases in self-assessed confidence, skills, and knowledge scores. However, it has been suggested that immediate post-exercise measures are imperfect indicators of learning, as they may indicate only temporary change.

High turnover of staff, non-clinical and clinical, stresses the need for ongoing upskilling and senior experienced staff support in acquisition of knowledge and skills needed during surge response in context of set strategic principles of hospital disaster response.

Psychological safety of participants and faculty was achieved by carefully determining objectives, establishing rapport during pre-brief inviting all present to be ally's in experiential training on the day. Comprehensive interactive debrief at the end of each session provided opportunity to make sense of the events, clarify processes and consolidate individual and group learnings [9].

Critical care and stabilization are upfront and mandates rapid escalation and senior expertise at the streaming or forward triage, while demand in investigation such as radiology was noted to be delayed. Establishing a team to promptly address coordination of appropriate imaging will contribute to timely and optimized utilization and prevent delay in results.

In rapidly changing complex adaptive events, communication is often compromised, contributing to effectiveness of the response. Recognizing its limitations and relative uncertainty in such an occurrence, might contribute to normalization of the nature of the process and acceptance of rapidly evolving decisions and shifts in processes [10].

Surveys were limited to hospital employees and that prevented some participants from contributing to pre-and-post data collection. There were limited baseline characteristics and outcome data collected limiting a more granular assessment of improvements. We did not perform quantitative analyses comparing the two different modes of delivery- tabletop versus real-time simulations. Agile delivery of both techniques is likely to enhance provider experience and should be tailored to the resources available.

The PSDR program will continue to conduct the needs assessment with collaboration with senior leadership as well as inter-agency contribution, and facilitate regular interdisciplinary learning opportunities, practical drills and scenario-based simulation training. In consultation with

Hospital leadership and Hospital Disaster response team, we are proposing to establish a regular secured Emergency response interdisciplinary training platform. Disaster response equipment and guidelines remain to be regularly assessed and updated by dedicated groups. Parallel to this, individual disciplines training needs should be assessed, and training and upskilling maintained as decided by PSDR leadership.

Developing a standardized response matrix scale to measure response will further guide training and estimate preparedness capability and capacity. This is likely to contribute to developed explicit evaluation outcomes that will expose shortcomings in preparedness [11, 12].

CONCLUSION

A low cost, immersive tabletop and in-person simulation training attracted a wide audience of participants and provided important information regarding readiness to respond as well as direction for future preparedness including training, interdisciplinary relations and equipment acquisition and maintenance. Furthermore, it equipped participants with knowledge and skills and increased their comfort (and likely capacity) to respond to a disaster event.

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Sažetak:

Uvod: Službe urgentne medicine (SUM) imaju značajnu ulogu u odgovoru na katastrofe, od dekontaminacije i trijaže do stabilizacije pacijenata uz istovremeno pružanje redovne zdravstvene zaštite postojećim i novim pacijentima. Ipak, s obzirom na retku učestalost ovakvih događaja, kao i unutrašnjih kriznih situacija, nivo praktične spremnosti osoblja često je ograničen. Ciljevi: Ciljevi rada bili su da se prikaže kako simulacione vežbe za scenario masovnog priliva pacijenata doprinose unapređenju koordinacije između institucija i kako mogu da posluže u planiranju budućih obuka za reagovanje u katastrofama. Metode: Razvili smo i sproveli dve virtuelne simulacione vežbe prijema u urgentnom centru i jedan praktični scenario hemijske, biološke i radijacione (CBR) dekontaminacije za multidisciplinarnu grupu kliničara i viših administrativnih kadrova. Podaci su prikupljeni putem upitnika pre i posle obuke, beleški sa debriefinga i povratnih komentara instruktora. Numerički podaci analizirani su deskriptivnom statistikom, a kvalitativni putem tematske analize. Rezultati: Od oko 100 učesnika, kompletne upitnike popunilo je 73 pre i 56 nakon simulacije. Struktura profesija bila je slična u obe grupe. Samoprocena učesnika pokazala je značajan napredak u razumevanju svojih uloga, timskom radu i osećaju sigurnosti u postupanju tokom katastrofa ($p < 0,001$ za sve posmatrane ishode). Kao glavni zaključak iz kvalitativne analize izdvojeno je da nivo organizovanosti odgovora direktno utiče na kvalitet budućih aktivnosti pripravnosti – od obuke osoblja i međusektorske saradnje do održavanja opreme. Zaključak: Simulacione vežbe pokazale su se korisnim alatom za jačanje poverenja i spremnosti timova na terenu. Rezultati ukazuju na potrebu za redovnim sprovođenjem ovakvih aktivnosti, kako bi se obezbedila kontinuirana obučanost osoblja i efikasan odgovor u realnim situacijama katastrofe.

Keywords: urgentna medicina, katastrofa, povrede, simulacija, obuka

REFERENCES

1. Emergency Management Victoria. State Emergency Management Plan (SEMP). Melbourne, 2023.
2. Department of Health Victoria. State Health Emergency Arrangements; in Government CS, (ed). 2023.
3. Rosenfeld JV, Mitra B, Smit V, Fitzgerald MC, Butson B, Stephenson M, et al. Preparedness for treating victims of terrorist attacks in Australia: Learning from recent military experience. *Emerg Med Australas*. 2018; 30: 722-4.
4. Nestel D, Jolly B, Watson M (Editors). *Healthcare Simulation Education: Evidence, Theory and Practice*: Wiley-Blackwell; 2017.
5. Dausey DJ, Buehler JW, Lurie N. Designing and conducting tabletop exercises to assess public health preparedness for manmade and naturally occurring biological threats. *BMC Public Health*. 2007; 7: 92.
6. Leighton K, Foisy-Doll C, Mudra V, Ravert P. Guidance for Comprehensive Health Care Simulation Program Evaluation. *Clinical Simulation in Nursing*. 2020; 48: 20-8.
7. Gaba DM. The future vision of simulation in health care. *Qual Saf Health Care*. 2004; 13 Suppl 1: i2-10.
8. Weeks MB. Training Emergency Department Charge Nurses Through Tabletop Exercises. *Prehospital and Disaster Medicine*. 2019; Vol. 34, Iss. s1, .
9. Johnson CE, Keating JL, Molloy EK. Psychological safety in feedback: What does it look like and how can educators work with learners to foster it? *Med Educ*. 2020; 54: 559-70.
10. Falk D, Cline P, Donegan D, Mehta S. A Novel Framework for Routine Versus Critical Communication in Surgical Education-Don't Take It Personally. *J Am Acad Orthop Surg*. 2023; 31: 115-21.
11. World Health Organization. WHO guidance on preparing for national response to health emergencies and disasters. 2021.
12. Bearman C, Hayes P, Thomason M. Facilitating teamwork in emergency management: The team process checklist. *International Journal of Disaster Risk Reduction*. 2023; 94: 103775.