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Incorporating simulation exercises using collaborative tools into disaster and emergency medicine curriculum—A pilot survey among Saudi Arabian professionals

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Abstract

This study evaluates the need for changes in Saudi Arabia's current disaster and emergency management curriculum, incorporating disaster exercises and using the collaborative tool of CSCATTT (Command and Control, Safety, Communication, Assessment, Triage, Treatment, Transport). Several statements were presented among five experts in three rounds of the Delphi technique; thereafter, the statement was presented as a questionnaire among 128 professionals and practitioners in disaster medicine through a quantitative survey. The results revealed that a high percentage of participants urged the necessity for several changes in the current Saudi curriculum of disaster and emergency medicine. According to the participants that the current curriculum does not cover essential knowledge in Command and Control, Safety, Communication, Assessment, and the roles of each individual and agency, needs to be enhanced by including several other aspects of disaster and emergency management, such as all risk management, internal and external communication, coordination, cooperation and collaboration in transport issues, teaching and training, and promoting multiagency collaboration and enable extracurricular activities. This study recommends continuous revision, and development of the current curriculum in Saudi Arabia and integration of the collaborative tools as well as the inclusion of disaster simulation using the same collaborative strategy. This study may be transferrable to other developing countries.

KEYWORDS
curriculum, disaster education, emergency management, healthcare personnel training, Saudi Arabia

1 | BACKGROUND

Disasters are sudden and unpredictable natural or human-generated events that can cause short-and long-term humanitarian and property losses and environmental damage (International Federation of Red Cross and Red Crescent Societies, 2023). The Sendai Framework for Disaster Risk Reduction 2015–2030 notes that boosting education and training efforts in the field of disaster medicine (DM) is a crucial part of disaster risk reduction (United Nations, 2015). Disaster education aims to prepare healthcare

professionals for the planning to manage these unexpected events and ensure that they acquire the required knowledge and practical skills to offer structural management, medical attention and interventions to victims during and after the occurrence of disasters (Wagner, 2018). As part of the educational program, disaster training has become the core of disaster education since it raises awareness regarding the randomness of natural disasters and the nature and dynamics of the required medical management (Algaali et al., 2015). It also enhances proactivity and substitutes the previously 'lessons learned concepts' in DM, allowing one to make mistakes in a safe environment with no harm to the affected population (Khorram-Manesh et al., 2016; Wennman et al., 2022).

The United States is one of the countries with disaster education programmes whose curricula are grouped into mandatory and elective courses. Nevertheless, only 20.7% of medical learning instructions have integrated mandatory disaster training programmes into their syllabuses (Markenson et al., 2013), even though voluntary disaster curriculum and training have a higher impact on the learners' knowledge and preparedness (Wiesner et al., 2018). Several training methods are being used, including the simulation approach, which has been considered an effective way to deliver disaster-related content (Gordon & Buckley, 2009).

Other countries, such as Italy, have pushed the inclusion of disaster-related curricula into school syllabi (Ragazzoni et al., 2013) and into Italian medical schools, emphasizing the need to obtain basic knowledge in disaster and emergency management at an early age through creative training approaches like virtual reality simulations and electronic learning (Ingrassia et al., 2014). Germany, France and the United Kingdom have the most programmes in the European Union (EU), predominantly using a face-to-face teaching strategy with training initiatives delivered in cross- and multidisciplinary content. Around 61% of the content in these curricula was competency-based (Keraminiyage et al., 2009; Khorram-Manesh et al., 2015; Voicescu et al., 2023).

Disaster management requires both structural and medical skills and knowledge. This is clearly shown in Major Incident Medical Management and Support courses, which were established in the 1980s with an emphasis on Command and Control, Safety, Communication, Assessment, Triage, Treatment and Transport (CSCATTT) elements of disaster management. The first four elements represent structural knowledge, followed by the three medical skills (Hodgetts, 2003). Previous studies by this research group, focusing on staff responsible for disaster management within hospitals' critical care, emergency and disaster department units in Najran, Kingdom of Saudi Arabia (KSA), have indicated a positive relationship between knowledge, practice and staff willingness to report for work during disasters and public health emergencies (DPHEs), and a need for improvement of staffs' knowledge in CSCATTT. There was also a lack of multiagency collaboration, mutual situation assessment and collaborative exercises. According to Bajow et al. (2015a), these shortcomings might be due to insufficiently trained educators, which were supposed to be managed by gradually adding e-learning and distance education to the educational curriculum. Nevertheless, a collaborative tool is needed for both instructors and students to standardize the educational initiative (Phattharapornjaroen et al., 2022; Sultan et al., 2023).

KSA is prone to natural and man-made hazards and has three medical curricula being delivered through a blended strategy. The Master's in Disaster Management Nursing Study Plan in KSA outlines 2-year learning activities containing compulsory and elective courses. Each of these types of courses was allocated 4 h. In the first semester, master's students learn about advanced health, execute research projects in the second semester, apply research plans in the third semester and analyse research works in the final semester. Conversely, the emergency medical services (EMS) and DM Fellowship Program offers two programmes, EMS and DM, which take 2 years (Alhajjaj et al., 2021). The duration of this disaster education curriculum is in block format. In the first year of study, students undertake system design and management, online and offline medical control, medical direction and specialized EMS. In the second and last year, learners take emergency management and humanitarian response (Alhajjaj et al., 2021). Later, they are engaged in health planning, management training, risk analysis and clinical medicine.

The coronavirus 2019 (COVID-19) pandemic was a turning point in many fields, forcing the implementation of virtual educational initiatives globally. Such educational development also necessitated new tools to enhance learning and promote the addition of a new virtual teaching approach in disaster and emergency medicine education and to the existing DM curricula.

Using the CSCATTT collaborative tool, this research group has been able to show an improvement in disaster management knowledge, willingness to work in risky situations and achieving a mutual goal as the final step in collaboration in the studied population in KSA (Sultan et al., 2021, 2023). The obtained results in KSA illustrated the need for continuous tabletop training, using educational and collaborative tools, to promote disaster preparedness as early as possible and as part of the teaching curriculum (Sultan et al., 2023). Such a change in curriculum deserves confirmation from experts and practitioners.

This study aimed to assess and evaluate the need to elaborate on KSA's current disaster and emergency management curriculum, according to the elements of CSCATTT, including incorporating disaster exercises using the same collaborative tool.

2 | METHODS

This study employed two different methodologies: A Delphi study among experts and a survey among practitioners.

2.1 | Delphi technique participants and procedures

First, based on the earlier research using CSCATTT, a survey consisting of several statements regarding the current disaster and emergency curriculum in KSA, was created by the first and the last

authors. Thereafter, the survey was sent to five experts within the field of disaster and emergency management with a range of experience between 15 and 30 years. The experts conducted three rounds of Delphi (Table 1). The statement was reviewed, adjusted, clarified and improved after each Delphi round until all experts achieved consensus before testing its feasibility, readability and face validity. The Delphi technique was found to be the most appropriate research tool for creating the survey since it involved expert consensus, remote participation, an iterative process, reduced cognitive biases and enhanced anonymity (Grisham, 2009). Suggestions and comments were considered thoroughly to finalize the statements before presenting them to the survey groups (Altmann et al., 2019), consisting of national experts and practitioners in DM.

2.2 | Survey participants and procedures

2.2.1 | Face validity

After finalizing the survey and its statements. It was initially tested on 20 participants, whose results were not included in the final outcomes of this study. Face validity is an informal review of a survey/questionnaire by nonexperts, who assess its clarity, readability, feasibility, comprehensibility and appropriateness for the target group before it was sent out to the study's main population/target group (Morse et al., 2002). The respondents could answer each statement using a Likert scale from 1 to 5 (1: *completely disagree*; 2: *disagree*; 3: *I do not know*; 4: *agree*; 5: *completely agree*), (see Table 3).

2.2.2 | Target group

The target group, consisting of 128 participants, was recruited from the Ministry of Health hospitals in KSA. The data was collected by the first author. The self-completion survey was presented to the participants through the Google Forms website. The respondents were asked to participate in this study and were all informed about the voluntary nature of their participation, that they could withdraw from the study with no consequences, that individual information will be deidentified and that the results will be kept secure and safe at the research center.

TABLE 1 List of experts participating in the Delphi technique.

Experts' initials	Specialty	Years of experience
Expert 1	Surgery and disaster medicine	>25
Expert 2	Prehospital care and disaster medicine	>15
Expert 3	Crisis management and prehospital care	>25
Expert 4	Crisis and emergency management	>15
Expert 5	Emergency and disaster medicine	>15

2.3 | Data analysis

The first author analysed the data, and the deidentified data were presented to all authors. Statistical Package for the Social Sciences version 20 (IBM) was used to calculate Cronbach's α to examine the homogeneity of the items in the subscales of the statements (survey of this study). Cronbach's α, which was 0.923, demonstrated high internal consistency; Brace et al. (2006) deemed this value to be satisfactory. Other results are reported in actual numbers and percentages descriptively.

3 | RESULTS

The total number of respondents was 137, but nine did not complete the survey and were excluded from the study. Data were collected from the remaining 128 respondents. Most of the respondents were males, accounting for 59.4% (40.6% females). About 78% of respondents were between 30 and 39 years old, followed by the 40 and above bracket, which accounted for 22.75%. Besides, the highest proportion of respondents, 81.2%, had a master's degree and the rest, 18.8%, had a PhD. Most participants were nurses, accounting for 51.6% of the sample, followed by physicians and paramedics at 28.9% and 19.5%, respectively (see Table 2).

The respondents were asked about 17 questions to gauge the current curriculum in disaster and emergency management in the KSA. In reporting, the percentages of 'agree' and 'completely agree' were combined, while those for 'disagree' and 'completely disagree' were aggregated.

About 75% of respondents disagreed that the current curriculum covers essential knowledge in command and control during emergencies and critical events, and only 14.8% of them agreed with the statement. Approximately 62.5% of participants disagreed that the curriculum enhances leadership roles, and 26.6% agreed. Moreover, about 56.3% refuted the claim that the curriculum covers probable risk areas

TABLE 2 Demographic data (n = 128).

Variable	*n*	%	Variable	*n*	%
Age by year			*Position*		
20–29	21	16.4	Physician	37	28.9
30–39	78	60.9	Nurse	66	51.6
40+	29	22.7	Paramedic	25	19.5
Gender			*Level of education*		
Male	76	59.4	Masters	104	81.2
Female	52	40.6	PhD	24	18.8
			Postdoctoral	0	0
Experience by year			*Nationality*		
1–9	24	18.8	Saudi	128	100
10–20	86	67.2	Non-Saudi	0	0
21–35	18	14			

engaging the healthcare sector in the KSA, while 19.5% agreed. Most participants, 64.9%, also disagreed that the curriculum enhances and enables the learner to manage diverse risks, while about 18.8% agreed. Additionally, 71.1% of respondents refuted the claim that the curriculum encourages the willingness and confidence of staff to report to work (17.9% of respondents agreed). Furthermore, most healthcare respondents, 60.2%, denied the statement that the curriculum aids in clarifying internal and external communication during emergencies, and only 20.3% of them agreed with the statement (see Table 3).

About 79.7% of participants were of the contrary view that the curriculum enhances and promotes multiagency collaboration, while 11% agreed with this perception. Approximately 68.8% of healthcare participants disagreed that the curriculum enables a joint assessment and understanding of the situation across sectors, and 13.3% agreed. Moreover, 70.3% disagreed that it enables extracurricular activities such as organizing multiagency training and exercises, whereas 17.2% of respondents agreed that it boosts extracurricular activities. In addition, 60.9% of respondents refuted the claim that the curriculum offers training in a diverse risk environment, such as a pandemic, mass casualty and others, while 18.8% agreed that it provides training in a diverse risk environment. Around 71.8% disagreed that it increases learners' knowledge about coordination and cooperation in transport issues, and only about 14.8% of the participants agreed. More so, about 61.7% of the participants refuted the statement that the curriculum enables e-learning and distance training, while 18% agreed with the statement. Lastly, almost all respondents, 96.9%, disagreed with the statement that the curriculum does not need any changes and is sufficient.

Around 38.3% of the participants agreed that the curriculum increases learners' knowledge and skills in triage and 50% acknowledged that it increases learners' knowledge and skills in medical treatment, while only 31.2 disagreed that the curriculum fails to enhance learners' knowledge of medical treatment. Approximately 89.1% of respondents concurred with the statement that the identified shortcomings in the curriculum in the current education system were due to a lack of instructors, while only a few participants, 2.4%, disagreed with the statement. Lastly, 88.3% of participants agreed that the current DM curriculum in the KSA needs clarifying collaborative tools to link various agencies (see Table 3).

4 | DISCUSSION

The main findings in this study indicate that the current curriculum in the KSA focuses mainly on the medical management of DPHEs, while there is a lack of covering the structural parts of disaster management. As indicated in our results, the first four items in CSCATTT are not fully covered by the current curriculum, while two of the last three (Triage, Treatment and Transport) seem to be sufficient. The last T representing transport depends on cooperation,

TABLE 3 Participants' responses ($n = 128$) on the survey by using a Likert scale from 1 to 5 (1: *completely disagree*; 2: *disagree*; 3: *I do not know*; 4: *agree*; 5: *completely agree*).

Statements	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)
Covers the essential knowledge in command and control during emergencies and time-critical events.	25.8	49.9	10.2	14.8	0
Enhances the role of leadership.	22.7	39.8	10.9	26.6	0
Covers probable risk areas engaging the healthcare sector in Saudi Arabia.	31.3	25	24.2	19.5	0
Enhances and enables the learner in the management of diverse risks.	35.2	29.7	16.4	18.8	0
Encourages the willingness and confidence of staff to report to work.	35.2	35.9	10.9	15.6	2.3
Clarifying internal and external communication during emergencies.	25	35.2	19.5	18	2.3
Enhances and promotes multiagency collaboration.	56.3	23.4	9.4	6.3	4.7
Enabling a joint assessment and understanding of the situation across sectors.	43	25.8	18	8.6	4.7
Enables extracurricular activities such as organizing multiagency training and exercises.	49.2	21.1	12.5	17.2	0
Offers training in a diverse risk environment, such as a pandemic, mass casualty, etc.	28.1	32.8	20.3	18.8	0
Increases learners' knowledge and skills in triage.	11.7	26.6	25.8	33.6	2.3
Increases learners' knowledge and skills in medical treatment.	15.6	15.6	18.8	44.5	5.5
Increases learners' knowledge about coordination and cooperation in transport issues.	44.5	27.3	13.3	12.5	2.3
Enables e-learning and distance training.	44.5	17.2	20.3	13.3	4.7
Identified shortcomings in the current education is due to the lack of instructors.	1.6	0.8	8.6	14.1	75
Clarifying collaborative tools and linking various agencies are one of the changes needed.	0	1.6	10.2	42.2	46.1
Does not need any changes and is sufficient as it is.	71.9	25	3.1	0	0

coordination and meaningful collaboration, that is, first partners should coordinate their resources. Later they need to cooperate and discover how they can adjust to each other's capabilities and limitations. Finally, they need to create a mutual goal to achieve (collaboration). These steps are not covered and supported by the current curriculum in all areas but specifically in transport issues. The results of this study can be imperative for other developing countries and might be transferable globally.

The collective gains from former studies published by this group indicated that there is a need for improvement of health care works' (HCW) knowledge in disaster management, that HCWs' safety issues should be considered as part of their willingness to report for work during ongoing DPHEs, and that collaborative exercises using diverse collaborative tools are indispensable in achieving the targeted academic goals of disaster education curricula (Sultan et al., 2021; Sultan et al., 2023; Sultan, Khorram-Manesh, et al., 2020; Sultan, Løwe Sørensen, et al., 2020). These findings are confirmed by the current study and other studies, such as a recent study conducted in Canada, which highly recommended including and teaching courses such as introduction to DM, safety, prehospital disaster management, decontamination indications and issues in the DM curriculum. These are collaborative topics, which may be used to improve and enhance Canadian emergency medicine skills (Belyea et al., 2023), and which indicate the importance of practical and collaborative sections in the existing curricula. A new study in Sweden, conducted on medical and nursing students by Robinson et al. (2023), confirmed that universities should teach and include specialized educational courses and programmes in their curricula to bridge the knowledge gap in DM and management, which also confirms the fact that these educational initiatives should be incorporated in medical and allied education as early as possible, as shown by the Italian group (Ragazzoni et al., 2013).

The findings of this study emphasized the need for collaborative tools according to the elements of CSCATTT, including the incorporation of disaster exercises using the same collaborative tool into the disaster and emergency medicine curriculum in the KSA. Using such tools in both the theoretical and practical parts of education can later be simply transformed into daily life, becoming an integrated part of a collaboration among agencies. Such changes, as suggested by the study's respondents are needed to enhance the disaster and emergency medicine curriculum in the KSA, particularly since the current curriculum does not cover essential knowledge in the first 4 elements of CSCATTT and thus the roles of each individual and agency. According to Garbutt et al. (2008), DM curricula may include the roles and responsibilities of command and control. However, to understand disaster aspects associated with individuals' and agencies' needs for cooperation across multiple roles for a fluent and collective effort during emergencies, other elements such as communication and mutual awareness of the situation are necessary (Veenema et al., 2016).

Recent research associated with disaster management issues highlights healthcare professionals' role in disaster education and training. Loke, Guo et al. (2021) note that disaster education and training prepare students and professionals with the skills and knowledge needed for their future disaster management. Disaster education and training incorporate disaster simulation, tabletop exercises, competency-based education and interprofessional training. Loke and Fung (2014) have shown that healthcare professionals' disaster competencies reflect grossly inadequate standards, which shows the need to develop a comprehensive learning curriculum for the public health profession (Loke & Fung, 2014). Several studies from KSA indicate the need to integrate disaster knowledge into the curriculum, and emphasis on disaster planning and response as well as on actual training simulations and exercises would help in preparing EMS students for disaster management (Almutairi et al., 2021; Alrazeeni, 2015).

In this study, the respondents confirmed that the current DM curriculum in the KSA needs to promote multiagency collaboration and enable extracurricular activities. This is in accordance with Douglas (2007), who confirmed that disaster preparedness should involve a collaborative model where training and exercising occur across mass casualty scenarios or live exercises and involve different stakeholders with varying disaster management skills and responsibilities working together for an effective response during major disaster scenarios. Another study by Khorram-Manesh et al. (2015) highlights the need to standardize disaster management through a multinational framework and advance intercooperation across different agencies within disaster management and response. In this case, the lack of standardization promotes deficiencies and gaps in disaster management and training, which affect disaster response for events whose magnitude cuts across multiple nations. This may confirm the standardization using simulation and tabletop exercises, improve management readiness and synchronize the process on different levels, locally, nationally and internationally (Khorram-Manesh et al., 2015). Another study by Khorram-Manesh et al. (2016) offers a multidisciplinary education and training model targeting people within disaster management, emphasizing that a disaster management curriculum should incorporate inclusion criteria, preprogram assessment, simulation, postprogram assessment, the second cycle of inclusion criteria and mastery of related content (Alrazeeni, 2015; Khorram-Manesh et al., 2016). Collaborative approaches are recommended by several agencies, such as the Center for Domestic Preparedness and the American government, occasionally employing collaborative approaches to adjust existing disaster preparedness and training courses (Marlow et al., 2019). They emphasize that the evolution of disaster response training through influence from responsible agents helps develop new courses to provide best practices education to involved stakeholders (Marlow et al., 2019). This statement is supported by studies, such as the one by Walsh et al. (2014), offering a consensus set of core competencies that define the baseline knowledge needed for disaster response by health professionals. The research argues the need to apply a revised hierarchical learning framework, whose disaster response practice involves a framework of competency sets that focus on different target audiences (Walsh et al., 2014). Veenema et al. (2016) identify that shaping nurses toward roles associated with being leaders, policymakers, educators, researchers and responders is the future of disaster nursing. For instance, the cooperation of nursing leaders serves as a recommendation that can advance the practice of disaster nursing since it creates a collective effort that can engage multiple nurses from all specialty areas (Veenema et al., 2016). Altogether, these statements

suggest the need for multiagency courses, where different agencies can learn from each other, knowing each agency's limitations and capabilities, using collaborative tools, such as CSCATTT to promote the development of collaboration and preparedness in DPHEs (Phattharapornjaroen et al., 2022; Sultan et al., 2023).

The respondents in this study emphasized the current DM curriculum in the KSA needs to be enhanced by including several other aspects such as diverse risk management, internal and external communication, coordination and cooperation in transport issues and enabling e-learning and distance training to encounter the lack of instructors. Subbarao et al. (2008) identify preparation and planning, detection and communication, incident management, safety and security, public health assessment and intervention, contingency, continuity and recovery, public health law and ethics as core education competencies for health professionals in a disaster learning curriculum. Continuous changes in the disaster curriculum are needed as indicated by Loke, Li et al. (2021), who evaluated whether the curriculum of the Master of Science in Disaster Nursing (MScDN) is up to standards maintained in the International Council of Nurses (ICN) CCDN V2.0 disaster nursing core competencies. The MScDN covers most of the ICN CCDN V2.0 competency proposals, although there is a need for its review to incorporate competencies missing from the syllabus (Loke, Guo, et al., 2021).

According to Bajow et al. (2015a), DM training across the medical school is a vital foundation for disaster preparedness since it advances students' preparedness for handling mass-casualty events and maintains the advancement of the KSA's disaster management and preparedness through mandatory, longitudinal curriculum in DM (Bajow et al., 2015a). Bajow et al. (2015b) also noted that the success of disaster preparedness and appropriate disaster response relies on the quality of training offered to underlying stakeholders and the availability of specialized instructors to bridge the deficit. Nevertheless, the educational response during the early phase of COVID-19 tends to promote e-learning and distance training. Thus, among others, virtual collaborative exercises were held using the CSCATTT tool and achieved an acceptable collaboration, learning and utility score (Reiners & Jayhooni, 2022; Sultan et al., 2021). While empowering the instructors might be a crucial factor in disaster education, other studies, such as the one by Cohen et al. (2013), report that using appropriate technology to create major incident simulations, focusing on emergency preparedness can be used to train and prepare disaster response stakeholders. According to Cohen et al. (2013), it is highly feasible to apply virtual world environments that simulate major incident training within healthcare settings. Such virtual world technologies offer affordable, immersive and accessible resources that can enhance major incident preparation for disaster response stakeholders.

5 | LIMITATION

The selected sample criteria for this study could be biased because of the educational degree preferences. The selection of the sample from only the Ministry of Health hospitals may create the potential for response bias, as hospitals in other sectors, such as medical services in the Ministry of Defence, the National Guard and the Interior, require reapplying to obtain ethical approvals for data collection.

6 | CONCLUSIONS

This study highlights the necessity of using collaboration tools in line with the CSCATTT's components in teaching DM, as well as the inclusion of disaster simulation using the same collaborative strategy in the emergency and DM curriculum in KSA. Based on the study's findings, healthcare professionals are fully aware of the curriculum and appreciate the contribution it makes to equipping learners for disaster and emergency management. However, they also admit the need for improvement in the current curriculum to boost learners' preparedness in the event of disasters and emergencies, aligned with changes that enhance and enable multiagency collaboration and extracurricular activities. It may still need the involvement of educational universities and more research in implementing collaborative exercises in the curriculum of emergencies and disaster management with all relevant agencies from other agencies, considering this study's findings.

AUTHOR CONTRIBUTIONS

Mohammed A. Salem Sultan: Conceptualization; methodology; software; data curation; investigation; writing—original draft and visualization. **Eric Carlström**: Visualization; methodology; review and editing. **Jarle Løwe Sørensen**: Visualization; methodology; review and editing. **Abdullah Saleh Alruwaili**: Visualization; methodology; review and editing. **Amir Khorram-Manesh**: Supervision; conceptualization; visualization; methodology; review and editing.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data that supports the findings of this study can be obtained from the corresponding author upon request.

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