Investigating the Role of Emergency Nurses and Disaster Preparedness during Mass Gathering in Saudi Arabia

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Abstract—Although emergency nurses, being the frontline workers in mass-gatherings, are essential for providing an effective public health response, little is known about the skills that emergency nurses have, or require, in order to respond effectively to a disaster event. This paper is designed to address this gap in the literature by conducting an empirical study on emergency nurses' preparedness at the mass-gathering event of Hajj in Mecca city. To achieve this aim, this study conducted a cross-sectional survey among 106 emergency department nurses in all the public hospitals in Mecca in 2014. The results revealed that although emergency nurses' role understanding is high; they have limited knowledge and awareness of how to respond appropriately to mass-gathering disaster events. To address this knowledge gap, the top three most beneficial types of education and training courses suggested are: hospital education sessions, the Emergency Management Saudi Course and workshop; and short courses in disaster management. Finally, recommendations and constructive strategies are developed to provide the best practice in enhancing disaster preparedness. This paper adds to the body of knowledge regarding emergency nurses and mass gathering disasters. This paper measures the level of disaster knowledge, previous disaster response experience and disaster education and training amongst emergency nurses in Mecca, Saudi Arabia. It is anticipated that this study will provide a foundation for future studies aimed at better preparing emergency nurses for disaster response. This paper employs new strategies to improve the emergency nurses' response during mass gatherings for the Hajj. Increasing the emergency nurses' knowledge will develop their effective responses in mass-gathering disasters.

Keywords—Emergency nurses, mass-gatherings, disaster preparedness, perceived role.

I. INTRODUCTION

MASS-GATHERINGS (MGs) are variously described, and there is no widely agreed definition. Some authors describe them as events attended by more than 1,000 people at a specific location, for a defined period of time [1]. Hammad [2, p.12] recently defined MGs as "events attended by a sufficient number of people to the level that strains the planning and response resources of the host where it is being held", while Imran and McLeod [3, p.50] suggest "a mass-gathering shall mean one which is likely to attract 5,000 people or more and continue for one hour or more". MGs pose special risks for attendees, because large numbers of people in small areas can facilitate the spread of infectious diseases or increase the risk of injury. The risk for a catastrophic incident occurring during such events also presents particular challenges in the prevention, harm minimization, and emergency response of healthcare facilities. The distinctive features of these events that can affect public health and safety services include their wide geographical spread, large levels of attendance, event duration and the security concerns that they present [1]. The goal for public health during MGs is to prevent or minimize the risk of injuries or illnesses and maximize the safety of participants [4].

In MGs, there are numerous risks affecting a significant number of people. Some of the common risks include accidents, stampedes, spread of infectious diseases, and terrorism, among others [5]. In the case of an emergency arising from any of the risks mentioned above, there will be a strain on the local healthcare facilities. This means that the nurses at the emergency departments (EDs) in hospitals should be adequately trained and prepared for such eventualities in order to know how to deal with such situations, which will help to reduce the number of potential casualties [6]. In particular, nurses working in the EDs must have the essential skills and experience to efficiently manage daily emergencies and chaotic circumstances.

There is a paucity of studies that directly measure emergency nurses' disaster preparedness in the context of MGs. Despite the importance of the role of emergency nurse in disaster preparedness, there are limited consideration to understand emergency nurses' knowledge and awareness. The present study was designed to address this gap in the literature, and to develop recommendations for best practice, with particular reference to the city of Mecca.

Several landmark studies have been carried out over the past decade to examine certain aspects of mass gatherings. While research may provide a clear understanding of the implications of mass gatherings, and underscore the need for more preventive measures, an overall assumption is that there is a need for a more conceptual analysis of mass-gathering medicine as a field of study [7]-[9]. In fact, the existing literature emphasizes the significance of healthcare workers being prepared, in order to provide an effective response during mass-gathering events.

Critically, the paucity of scholarly literature regarding the preparedness of emergency nurses for mass-gathering disasters indicates a gap that calls for further research. Arbon [10] shared this perspective in his earlier study when he

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suggested the application of conceptual models and development theories to the critical understanding of health effects in mass gatherings. Arbon was also of the opinion that while there was a lack in research, conceptual models guiding research and the practice of nurses in emergency mass-gathering situations were also lacking. The aim of this study was to assess the level of emergency nurses' disaster response preparedness for MGs, such as the annual Hajj pilgrimage, using a cross-sectional survey of registered emergency nurses currently employed in all the public hospitals in Mecca, Saudi Arabia. The findings will be used to develop recommendations for best practice and training, with particular reference to the city of Mecca.

II. METHODOLOGY

A. Study Design

A cross-sectional online survey was selected as the most appropriate research design for the purposes of the study. A self-administered questionnaire was completed by eligible participants, including a combination of structured and open-ended questions. A survey questionnaire enables researchers to collect a large amount of data over a short time-period, at low cost, and it is a familiar data collection technique to many people. Online survey administration provides convenience, as busy nurses can complete the questionnaire in their own time, and although the absence of researchers reduces control, it increases anonymity for the participants, encouraging them to give more honest responses.

B. Site and Setting

The setting for this study was the city of Mecca, in Saudi Arabia, and the study setting included all the public hospitals in Mecca. Therefore, the study population should be broadly representative of the target population. Mecca was selected as the Hajj MG is held there annually, thereby increasing the potential risk for acute emergency medical and general clinical care [11].

C. Study Population and Target Sampling

The target study population consisted of registered nurses working in the EDs of all the public hospitals in Mecca (N=350). 106 emergency nurses returned completed questionnaires (30% response rate).

D. Study Instrument

The instrument used to gather primary data for this study was an online self-administered questionnaire. The questionnaire included both structured and open-ended questions to collect standardized responses and to allow respondents to answer spontaneously and give more information, where appropriate [12]. The questionnaire was designed and hosted on the 'Survey Monkey' website – a resource that simplifies the online survey process when designing and administering a questionnaire.

The questionnaire included 18 questions, divided into five sections, as follows: (1) Knowledge and Awareness in relation to disaster preparedness, measured on a 1-5 Likert scale.

Question 1 was made up of 5 items measuring the attitudes of the nurses in relation to knowledge and awareness. (2) Roles of nurses in disasters: 12 items on a 5-point Likert scale measured the role of nurses in providing care, psychological assistance, and triage. (3) Education and training: four items were designed to ascertain how emergency nurses in Mecca are educated and trained, and types of disaster education and training available for the respondents. The respondents were requested to indicate the kind of disaster training they had completed. (4) Previous experience of disaster response: nine items explored respondents' reactions to disasters in the past, and issues related to duration of work in emergency departments.

E. Ethics Approval for the Study

The Ministry of Health in Saudi Arabia approved the study on 26/8/2014. The researcher applied for the permit by sending a request letter, which was seconded by the faculty. The university granted permission on 19/8/2014 after the researcher submitted the proposal. The public hospitals approved the study on diverse dates between 10/11/2014 and 24/11/2014. The researcher made a formal request for approval by sending a request letter supported by the permits from the Ministry of Health and the University.

F. Data Collection

The questionnaire was piloted with emergency nurses in the hospital where the first author is employed, and then it was administered to all the public hospitals in Mecca. The questionnaire was circulated to the managers in each of the selected hospitals by sending the link for the online survey to their individual emails. The hospital managers were asked to distribute the questionnaire among the emergency nurses in their hospitals within a two-week period.

G. Data Analysis

The survey data collected was analysed quantitatively to answer this study's research aims, using SPSS (Statistical Package for Social Scientists) version 22. The raw data were downloaded from the Survey Monkey website, checked for missing values and prepared for analysis. Descriptive statistics were generated including mean, median, mode, standard deviation, frequency counts and percentages, and crosstabs with the Chi-square statistic. Where appropriate, charts and figures were produced to facilitate understanding and communicate important findings visually to the reader. Statistical significance was defined as $p<.05$ for all statistical tests.

III. RESULTS

A. Demographic Characteristics

Table I shows the demographic characteristics of the respondents. The majority were aged between 20 and 40 years old. Male nurses took more part (52.8%) than female nurses (24.5%), although 22.6% of respondents declined to specify their gender. Over half of the respondents were employed as nursing technicians and nursing specialists (42.5% and 29.2%,

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respectively), and a few were nursing aids (3.8%). Other occupations were master of nursing (3.8%). 51.7% (*n*=45) of nurses have been working in their current ED between 0 and 5 years and over half (57%, *n*=49) have been employed in the field of emergency nursing for 0—5 years.

TABLE I
DEMOGRAPHIC CHARACTERISTICS OF THE STUDY RESPONDENTS (N=106)

Variable	Frequency	Percentage (%)
Age group		
20–30 years	48	55.8
30–40 years	31	36.0
40–50 years	4	4.7
50–60 years	2	2.3
60+ years	1	1.2
Gender		
Male	56	52.8
Female	26	24.5
Unspecified	24	22.6
Current clinical position		
Nursing technician	45	42.5
Nursing specialist	31	29.2
Nursing aid	4	3.8
Other current clinical position	4	3.8
How many years have you worked in your current emergency department?		
0–5	45	51.7%
6–10	29	33.3%
11–15	10	11.5%
16–20	1	1.1%
More than 20	2	2.3%
How many years have you worked in the field of emergency nursing?		
0–5	49	57.0%
6–10	24	27.9%
11–15	8	9.3%
16–20	2	2.3%
More than 20	3	3.5%

B. Emergency Nurses' Disaster Knowledge and Awareness

The findings revealed that emergency nurses' knowledge levels of disaster preparedness are extremely low. Table II shows the respondents' responses to the knowledge test on disaster misconceptions. Only 34% of the respondents correctly knew that most casualties from a disaster arrive to EDs via the Saudi Red Crescent; only 32% correctly knew that disease epidemics are an almost inevitable result of the disruption and poor health caused by major disasters; only 29% correctly knew that the poor are more at risk of death than rich people or the middle classes during a disaster; only 20.6% correctly knew that un-buried dead bodies would create a disease epidemic following an MG disaster; and only 16.3% of respondents correctly knew that all victims of a chemical biological radiological (CBR) incident would need to have dangerous substances removed at the scene of an incident prior to their arrival to hospital. Thus, the findings demonstrate that there are major training deficits in emergency nurses' knowledge and awareness of how to effectively respond to disaster events within all of Mecca's public hospitals, and emergency nurses require more knowledge.

TABLE II
RESPONSES TO KNOWLEDGE TEST ON DISASTER MISCONCEPTIONS (N=106)

Statement	Frequency Who Gave the Correct Answer	Percent Who Gave The Correct Answer
• The majority of casualties from a disaster will arrive to your emergency department via the Saudi Red Crescent.	35	34%
• Disease epidemics are an almost inevitable result of the disruption and poor health caused by major disasters.	33	32%
• The poor are more at risk of death than rich people or the middle classes during a disaster.	30	29%
• Un-buried dead bodies will create a disease epidemic following a mass-gathering disaster.	21	21%
• All victims of a CBR (chemical biological radiological) incident will have dangerous substances removed at the scene of an incident prior to their arrival to hospital.	17	16%

C. Understanding of the Role of Emergency Nurses During MGs

Table III shows the findings regarding emergency nurses' perceptions of their role during Hajj mass gatherings. Respondents perceived their dominant role as providing general assessment and caring for patients (38%), followed by triage (26%), then resuscitation (21%); whereas the respondents gave lower priority to their role involving leadership (14%); and only one respondent viewed her role as including providing psychological care (1%).

TABLE III
EMERGENCY NURSES' PERCEPTIONS OF THEIR LIKELY ROLE IN AN MG DISASTER RESPONSE DURING HAJJ PILGRIMAGE RESPONDENT (N=86)

What is your likely role in a mass-gathering disaster response during the Hajj?	Frequency	Percentage
• General assessment and caring of patient	33	38%
• Triage	22	26%
• Resuscitation	18	21%
• Leadership	12	14%
• Psychological care	1	1%

TABLE IV
TIMING OF WHEN RESPONDENTS LAST ATTENDED DISASTER TRAINING (N=106)

		Frequency	Valid Percent
Valid	More than 6 months ago	29	34%
	More than 12 months ego	20	23%
	More than 2 Years ago	37	43%
	Total	86	100%
Total		106	

D. Disaster Education and Training

1. Frequency of Disaster Education and Training

All the respondents indicated that they had received some form of disaster education and training. However, the frequency of this training was limited, as Table IV shows. In terms of the timing of the training, only 34% attended training 6-12 months ago; 23% attended 12-24 months ago, and 43% attended over 2 years ago. To be fully prepared for an MG

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disaster, all emergency nurses should thoroughly read their department's major incident plan.

2. Education and Training Courses Required to Prepare for Disaster Situations

Emergency nurse respondents indicated that the top three most beneficial types of education and training courses that can help them to prepare for disaster situations are: (1) hospital education sessions (43% of responses). Hospital education sessions involve free courses provided by health care professionals from the Training and Education Centers in Saudi hospitals for the health worker as required. (2) Emergency Management Saudi Course and workshop, which 27% of respondents recommended. Saudi Emergency Management in Mecca provides special courses for emergency nurses over 2-3 days to improve their knowledge and prepare them for the Hajj event. Finally, (3) short courses in disaster management, which 11% of respondents recommended. These are private courses run by private organizations in the field. In contrast, university training in disaster management was perceived as required by only a minority of respondents (8%), as were online education about disaster management (6%) and self-learning (3%). Only 2% of respondents thought that drills/quarterly drills and fire preparedness training were required to prepare for MG disasters.

E. Level of Awareness of Department's Major Incident Plan

A major incident plan is a contingency plan from hospital departments including the major processes required to be in place in order to prepare for unexpected incidents. Emergency nurses are required to be aware of this plan because it provides them with effective arrangements for responding to major incidents if they arise. Table V shows that only 47.1% of respondents had thoroughly read their department's major incident plan; whereas 23% had flicked through it, and 22% had not read it. A further 8% of respondents did not know whether they had one. These findings indicate that 53% of emergency nurses in Mecca public hospitals may not have thoroughly read the major incident plan, and some of them do not even know that there is a written major incident plan. This means that during a disaster event, over half of the emergency nurses in Mecca's public hospitals may not know or follow the correct standard practices expected in their ER department. This could impact patient safety and stress following a major incident.

TABLE V
FREQUENCY PERCENTAGE OF EMERGENCY NURSES WHO READ THEIR
DEPARTMENT'S MAJOR INCIDENT PLAN (N=86)

I have read the department's major incident plan	Frequency	Percent
I didn't know we had one	7	8%
No	19	22%
Yes thoroughly	41	47%
Yes, I have flicked through it.	20	23%
Total	87	100%

F. Previous Disaster Response Experience

Almost all (99%) of the respondents had previous experience of some type of disaster response. Fig. 1 shows that 47% had experience of a fire disaster, 24% of a transport disaster, 22% of a building collapse (21.7%), 16% of a flood, 12% of a stampede (12.3%), 12.3% of an epidemic outbreak, 9% of a biological and chemical disaster, and 7% of other disasters, including Hajj, myocardial infarction, explosion, road traffic accidents and rain disasters. Only one respondent said that they had no previous disaster experience.
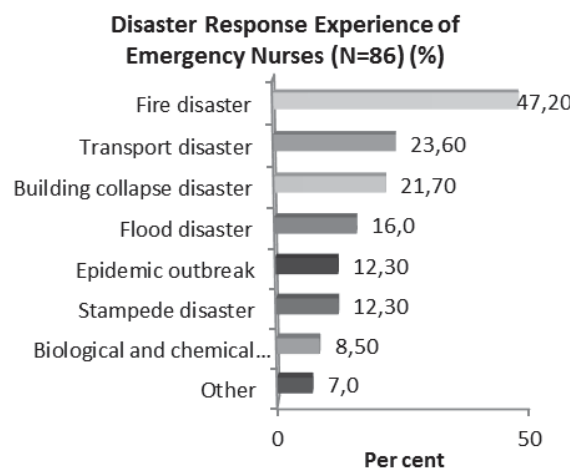

Fig. 1 Previous disaster response experience of emergency nurses (N=86) respondent (%)

IV. DISCUSSION

A. Level of Awareness and Knowledge of Saudi Nurses to Respond to Any Case of MG Disaster

The findings from this survey revealed that the emergency nurses who participated in this study have low inadequate levels of knowledge and awareness which may hinder their ability to respond appropriately and effectively to disaster response events, such as the Hajj pilgrimage. However, the utilization of Hospital Emergency Codes (among 57.5%) to communicate the awareness was fair. The findings in the literature also indicate that disaster knowledge and awareness are a critical component in relation to the preparedness of Saudi nurses, especially during mass gatherings. According to [13], the Saudi Ministry of Health places emphasis on the application of practical and effective means of communication with regard to disasters. The health authority highlights communication of information on disasters before, during, and after, the Hajj [14].

According to [13], during Hajj, twenty-four committees are tasked with the responsibility of promoting effective communication of disasters. The Supreme Hajj Committee, for instance, is tasked with carrying out disaster-related studies and the provision of recommendations. On its part, the Hajj Preventive Medicine Committee undertakes preventive measures prior to, during, and after, the Hajj [15].

Information regarding imminent disasters or those with a higher likelihood of occurring is monitored from a wide range of sources. The sources include Kingdom of Saudi Arabia Ministry of Health (KSA MoH) and WHO. Other sources include Public Health England (PHE) and European Centre for

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Disease Prevention and Control [ECDC] [13], [15]. Given the communication structure and the various information sources, it is apparent that Saudi nurses are well informed with regards to disasters. The awareness and effectiveness of the nurses is also apparent from the excellent management of the Hajj pilgrimage.

B. Education and Training Courses Required to Prepare for Disaster Situations

Regarding levels of education and training for disaster situations, they seem to very much depend on the clinical position of the nurses. This provides evidence that involvement in disaster exercises needs to become more standardised, so that all nursing grades in the emergency department receive this training two or three times, to ensure that all nurses can respond competently. The findings also indicate that the Saudi Ministry of Health has undertaken extensive education and training programs for emergency nurses (89.1%). The health authorities, for instance, coordinate initiatives between health professionals, statutory groups, and community bodies [13], [16]. The initiatives are aimed at ensuring that the emergency nurses gain the appropriate knowledge and training with regards to disaster management.

One of the key developments with regards to education and training for Saudi emergency nurses is the emergence of Hajj Medicine. According to [14], this field of medicine entails management and control of emerging and common health problems during Hajj. Consequently, Saudi emergency nurses are some of the best trained in handling issues during disasters, especially due to the knowledge gathered from previous Hajj experiences.

C. Advantages of Previous Disaster Response Experiences for Emergency Nurses, for Providing Effective Medical Services in the Future

The finding that 99% of the respondents had previous experience in relation to disaster response concurs with previous studies, which indicate that the annual undertaking of the Hajj in Saudi Arabia has significant influence on the level of previous disaster experience among Saudi nurses. In 2008, for instance, the World Health Organization (WHO) lauded Saudi public health authorities' exemplary management of communicable diseases in mass gatherings. The WHO based their praise on the high level of experience among health workers and their previous undertakings during the Hajj pilgrimage [4], [13].

It is noted that some Saudi emergency nurses lack previous experience in disaster management. However, it is apparent that the level of exposure to mass gatherings is higher in Saudi Arabia than in most countries. According to [2], South Australian emergency nurses have limited experience of disasters. Consequently, the experience of some of the nurses extends to others in the profession. This is apparent from the performance recorded in the country's health sector when managing and responding to emergencies during Hajj.

According to [14], Saudi public health officials and workers, together with policy makers, have seasoned experience and expertise in relation to disaster. The experience stems from the seasonal Hajj and from other gatherings. The experiences form the basis of a new field of medicine in Saudi, referred to as Hajj Medicine [13].

D. Develop the Roles of Nurse Emergency and Disaster Preparedness During MG for the Nurses in Mecca city.

Overall, the findings from this study reflect those in previous research. Saudi nurses, especially those in the ED, perform a wide range of activities, in addition to the conventional ones, such as general assessment and care of patients, triage, resuscitation, leadership and psychological care. The Saudi nation is prone to other disasters, such as fire outbreaks, floods, and collapse of buildings, however, it is apparent that preparations for disaster management during the Hajj have increased the level of expertise among nurses. It is noted that overcrowding during the Hajj results in trampling of pilgrims and other accidents [17]. Consequently, Saudi emergency nurses have to attend to victims of such occurrences. In addition, the nurses deal with patients who fall victim to respiratory infections, especially the frequently reported 'Hajj cough' [4]. According to [17], extreme physical stressors, including crowding, sun exposure, traffic congestion and thirst, enhance the risk of communicable diseases. Saudi emergency nurses facilitate the surveillance and screening of Hajj pilgrims for communicable diseases and related illnesses. In addition, the practitioners educate and counsel the pilgrims appropriately on how to avoid such diseases.

Saudi emergency nurses are also tasked with the responsibility of facilitating and manning various supplies necessary for infection control. For instance, the nurses supply hand disinfectants. In addition, they facilitate hospital disinfection and sterilization of surgical tools [18]. Saudi emergency nurses also assist in checking for proof of vaccinations, especially for meningococcal meningitis; vaccination against this condition is a requirement for all those attending the Hajj pilgrimage. In instances where any pilgrims are not vaccinated, the nurses help with their containment, quarantine, and vaccination.

In addition to their academic training, Saudi emergency nurses are trained on key aspects of disaster preparedness and management during mass gatherings. According to [13], the Supreme Hajj Committee is tasked with the responsibility of developing an annual Hajj plan and related studies. The studies entail emergency response and disaster preparedness. Others entail providing recommendations for emerging issues [19]. As a result of Hajj, the Saudi Ministry of Health is able to develop effective emergency management and disaster preparedness programs, especially in nursing education [20].

V. CONCLUSION

In conclusion, this paper discussed the importance of disaster preparedness during mass gathering for emergency nurses, which is considered the first line to be affected during mass-gathering disasters. Also, this paper explored the critical factors influencing emergency nurses' responses during mass gatherings in Mecca city, including emergency nurses' knowledge levels, perceived roles, education/training, disaster

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experience and required training for effective response at mass-gathering disasters. The findings of this paper highlighted that emergency nurses in Mecca public hospital have low knowledge which will impact their effective responses to any mass gathering disaster during the Hajj. However, they have a high level of understanding of their role. Thus emergency nurses need to develop their knowledge training and skills regarding mass gatherings to provide an effective response. With this aim in mind, this study has identified a need for nursing aids/technicians to gain more experience of fire disaster both directly and vicariously through nurse specialists sharing their experiential learning from their greater disaster experience. This recommendation should be facilitated by policy makers and those responsible for training and education of nurses. The present study also identified many beneficial clinical skills in disaster response. For example, in developing courses for emergency nurses to respond to mass-gathering disasters, the present findings indicate that a specific focus on CPR experience and knowledge, triage, assessments, critical thinking skills, and all basic nursing skills is crucial, as is confidence-building, and training nurses how to be calm in a disaster.

A. Limitations and Suggestions for Future Research

A limitation of this study is the cross-sectional design, which provides a 'snapshot' of emergency nurses' knowledge, role, training, experience and recommendations, at one moment in time. A longitudinal mixed methods study design is recommended, to measure emergency nurse's disaster preparedness on an annual basis using a quantitative survey, at least six months before Hajj, to allow sufficient time to process results and implement training initiatives to overcome knowledge/practice deficits in disaster response. A qualitative focus group component is also needed, to explore in detail emergency nurses' experience of Hajj, to inform future training requirements, and to gather in-depth narrative responses on the barriers and facilitators of effective emergency nurse management of disaster events. Second, this study included emergency nurses', but it is also important to survey and interview doctors and paramedics, who play an equally crucial role in reducing casualties at Hajj, and other MG disaster events. Finally, the small sample size (N=106), non-random sample, and single setting (Mecca city public hospitals) mean the results can only be generalized to other regions of Saudi Arabia with caution. A larger national survey of all emergency nurses who have a role in MGs is needed, to gain a broad understanding of their knowledge, experience and training needs for MG response, so that the Ministry of Health can develop a nationwide policy-driven approach to improve and standardize regular MG and Hajj-specific disaster response training for best practice.

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