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Emergency Nurse Preparedness during Mass Gatherings: a cross-sectional survey in hospitals in Mecca, Saudi Arabia

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ABSTRACT

Objectives: To assess hospital Emergency Nurses' self-reported knowledge, role awareness and skills in disaster response with respect to the mass-gathering event of Hajj in Mecca.

Design: Cross-sectional survey with primary data collection and non-probabilistic purposive sample conducted in late 2014.

Setting: all four public hospitals in Mecca Saudi Arabia

Participants: 106 registered nurses in hospital emergency departments

Main outcome measure: awareness, knowledge, skills, and perceptions of emergency nurses in Mecca with regards to mass-gathering disaster preparedness

Results: Although Emergency Nurses' clinical role awareness in disaster response was reported to be high, nurses reported limited knowledge and awareness of wider emergency and disaster preparedness plans, including strategies linked to managing mass-gathering disaster events. Their knowledge was lowest for coping with chemical biological radiological incidents, and highest for the handling of emergency room disaster casualties arriving via Saudi Red Crescent. Respondents identified three key training initiatives as opportunities to further develop their professional skills in this area: a) hospital education sessions, b) the Emergency Management Saudi Course, c) bespoke short courses in disaster management.

Conclusion: Recommendations and constructive strategies are developed to provide best practice enhancing disaster preparedness.

Strengths and Limitations of this Study

This paper adds to the emerging body of knowledge on Emergency Nurses' role and involvement in mass-gathering disasters, being the first study to report empirical findings on this important topic in Saudi Arabia and the city of Mecca. The results from this study also help illustrate the level of preparedness of Emergency Nurses for disaster response during the Hajj mass-gathering in Mecca, Saudi Arabia. In addition, this study suggests strategies to improve professional skill of the nurse workforce in this important area of clinical practice. However, the limitations of this study include its cross-sectional design, the relatively small sample size, the use of non-random sampling, and reporting evidence from one geographic area.

Keywords: Emergency Nursing, Mass-gathering, Hajj, Disaster Preparedness, Saudi Arabia

Word Count: (3841).

INTRODUCTION

Background

Mass-gatherings (MGs) are variously described in the literature with no widely agreed definition. Most researchers agree that MGs are events attended by a large number of people (i.e. over 1,000) at a specific location, for a defined period of time[1]. Hammad *et al*. 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"*[2]. In addition to straining the planning and response resources of the host country, MGs also pose special risks for attendees. Common risks include injuries and accidents, stampede, spread of infectious diseases, and terrorism among others[3].The risk of 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, their duration and the security concerns that they present[1]. For health care services the main objective during MGs is to prevent or minimize the risk of injuries or illnesses and maximize the safety of participants[4].

In the case of an emergency arising from any of the above risks, there will be a strain in the local healthcare facilities. Therefore, the nurses at emergency departments (EDs) in hospitals should be adequately trained and prepared for such eventualities to provide for an effective response and help in reducing the number of potential casualties[5]. In particular, nurses working in EDs must have the essential knowledge, skills and experience to efficiently manage emergencies and cope with often chaotic circumstances accompanying a disaster event.

An ascent body of literature informed by empirical work in this area has started emerging. Hammad et al. (2011) in a mixed methods study reported on the knowledge and perceptions of emergency nurses in South Australia on their role in disaster preparedness. Alexander (2007) explored the beliefs in common myths held by Massachusetts University students and three groups of trainee emergency workers in Italy. The research revealed that the participants held various misconceptions regarding disaster management. Magnaye et al. (2011) sought to determine the opinions held by emergency nurses in Philippines with regards to their role in disaster management. The research also examined their preparedness and levels of their skills in response to disasters.

Studies in this area suggest that a number of factors influence the ability of nurses to respond to MGs. Disaster education and training is a key element for hospital nurses enabling them to respond successfully (Veenema, 2006). Drills and exercises, as well as military training and postgraduate studies focusing on disaster response, constitute important aspects of education and training. Nonetheless, there is less agreement in the literature regarding the content and the mode of delivery of such education programs. In addition, the relevance of existing programs to nursing professionals in emergency departments is questioned (Enock & Jacobs, 2012).

A second important factor influencing the effectiveness of emergency nurses' response to mass-gatherings is their level of knowledge and awareness of the appropriate course of action (Conlon and Wiechula, 2011). Welzel and colleagues (2010) argue for the necessity of early communication of relevant information to emergency nurses, which provides them with the opportunity to simulate their response, thus increasing their response capability.

Prior disaster management experience constitutes a third key factor in relation to emergency nurses' preparedness in MG disasters (Rassin *et al*., 2007).Welzel *et al*. (2010) argue that previous experience can be gained by nurses from societies where disasters are uncommon by volunteering in societies more prone to disasters. In addition, disaster education and training can be enhanced to facilitate experience in emergency nurses (Ranse et al., 2013). Finally, there is a need for collaboration and communication between the different stakeholders involved in the provision of care in the emergency departments. Such professionals include the nurse, physician, management team, and support staff (Martin *et al*, 2010).

Despite its importance for clinical practice, little is known about the skills needed by frontline ED nursing staff to respond effectively to the requirements of their clinical role. In particular, there is a paucity of studies that directly measure emergency nurses' disaster preparedness in the context of MGs (Arbon, 2004). Furthermore, there is an absence of studies on assessing emergency nurses' knowledge and role awareness in disaster response in Saudi Arabia, a country which hosts annually one of the world's largest mass-gathering events.

Study objectives

This study aims to enhance the current understanding on emergency nursing and disaster response preparedness in MG events. This study was designed to specifically assess the knowledge and disaster preparedness in relation to the annual Hajj pilgrimage of registered nurses currently working in the emergency departments of all public hospitals in Mecca.

The study had three key objectives:

1. To assess the level of awareness and knowledge unsuccessfully responding to mass-gathering disaster events of the Emergency Nurses working in public hospitals in Mecca
2. To assess the current roles and skills in disaster preparedness during the Hajj mass-gathering as reported by the Emergency Nurses
3. To identify the type of training programs and education deemed appropriate and relevant by the Emergency Nurses

METHODS

Study design

A cross-sectional online survey was selected as the most appropriate research design for the purpose of the study (Creswell, 2014). 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. Online survey administration provides convenience for busy professionals, such as nurses, to complete the questionnaire in their own time. Although the absence of researchers reduces control, it increases anonymity for participants, encouraging them to give more honest responses.

Study site and population

The setting for this study included all four public hospitals in Mecca, Saudi Arabia. Mecca was selected as the Hajj MG is held there annually, thereby increasing the potential risk for acute emergency medical and general clinical care (Rassin *et al*., 2007). We used non-probability purposive sampling (Bowling, 2005). The target study population consisted of all registered nurses working in the EDs of all public

hospitals in Mecca (N=350). Participation in this study was voluntary and 106 emergency nurses returned completed questionnaires (30% response rate).

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 both standardized and spontaneous responses and to allow respondents provide more in-depth information, where appropriate (Bowling and Ebrahim, 2005). 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 development of the questionnaire's content was informed by similar studies (Alexander 2007; Hammad, Arbon & Gebbie 2011; Magnaye et al. 2011). The questionnaire included 18 questions, which were divided into five sections: (1) Knowledge and Awareness in relation to disaster preparedness. This section of the questionnaire addressed this aspect of the study by contextualising disaster response in the hospital setting in Mecca. The responses of the participants were measured in a 5-Point Likert Scale (1 for Strongly Agree and 5 for Strongly Disagree). (2) Roles of nurses in disasters. This section comprised 12 items, which were measured in a 5-Point Likert Scale and focused on 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 identify types of disaster education and training available to the respondents. (4) Previous experience on disaster response; nine items explored respondents' reactions to disaster events in the past. (5) The fifth section of the questionnaire explored the demographics of the participants

Ethics approval

The School of Health Sciences Research Ethics Committee, City University London and the Ministry of Health in Saudi Arabia and the R&D departments of the participating hospitals approved the study. All participants provided informed consent.

Data collection

The questionnaire was piloted with Emergency Nurses in the hospital the first author is employed, and then administered to all public hospitals in Mecca. The questionnaire was made available in English language. Forward and backward translations to the Arabic language were conducted by two bi-lingual Emergency Nurses during the piloting stage. The importance of having an English language translation was due to the fact that the majority, 53.1% in 2009, of nurses working in public hospitals in Saudi Arabia are non-Saudi nationals (MoH, 2013). Also all nurses in the emergency departments in the hospitals studied were fluent English speakers. 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 in September 2014. Participation by respondents was voluntary.

Data analysis

The survey data collected was analyzed quantitatively using the statistics analysis software 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, frequencies counts and percentages, and crosstabs with the

Chi-square statistic. Charts and figures were produced to facilitate understanding and comparisons, where appropriate. Statistical significance was defined as $p<.05$ for all statistical tests.

RESULTS

Respondents' Demographic Characteristics

Table 1 summarizes the demographic characteristics of the respondents. The majority were aged between 20 and 40 years. There were more male(52.8%) than female nurses (24.5%), although 22.6% respondent declined to specify gender. Over half of the respondents were employed as either nursing technicians or nursing specialists (42.5% and 29.2%, respectively); few were nursing aids (3.8%).About 52% of the respondents reported0-5 years' experience in ED, followed by 6–10 years for 32.9%, and 11.0% with 11–15 years. Most respondents had worked in the field of emergency nursing for 0–5 years and 6–10 years (43.4% and 21.7%, respectively); 12.2% of the respondents had over 10 years' field experience, of which 2.8% of respondents had over 20 years' experience.

Table 1: Demographic characteristics of 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
Years of work in current emergency department		
0–5	43	52.4
6–10	27	32.9
11–15	9	11.0
16–20	1	1.2
More than 20	2	2.4
Years of work in the field of emergency nursing		
0–5	46	43.4
6–10	23	21.7
11–15	8	7.5
16–20	2	1.9
More than 20	3	2.8

Emergency Nurses' Disaster Knowledge and Awareness

Emergency Nurses 'reported knowledge of disaster preparedness was surprisingly very low. Table 2 shows the responses to the 'knowledge assessment test' on topics where there are often misconceptions on appropriate management of disaster events. Only one in three of the respondents(34.3%) correctly responded that most casualties from a disaster arrive to EDs via the Saudi Red Crescent; similarly, only 32% correctly responded that disease epidemics are an almost inevitable result of the disruption and poor health caused by major disasters; only 29.1% were mindful that the poor are more at risk of death than rich people or the middle classes during a disaster; only one in five (20.6%)correctly responded that un-buried dead bodies would create a disease epidemic following an MG disaster; and only one in six (16.3%)responded correctly that all victims of a chemical biological radiological (CBR) incident will have dangerous substances removed at the scene of an incident prior to their arrival to hospital. These findings demonstrate a significant deficit in Emergency Nurse's reported knowledge and awareness to effectively respond to disaster events within all Mecca's public hospitals.

Table 2: Respondents 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	34.3%
Disease epidemics are an almost inevitable result of the disruption and poor health caused by major disasters.	33	32.0%
The poor are more at risk of death than rich people or the middle classes during a disaster.	30	29.1%
Un-buried dead bodies will create a disease epidemic following a mass-gathering disaster.	21	20.6%
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	16.3%

The Role of Emergency Nurses during MGs

Table 3 presents the Emergency Nurses' perceptions of their role during the Hajj mass gathering. Respondents perceived their dominant role as providing general assessment and caring for patients (38%), followed by triage (26%) and resuscitation (21%); whereas the respondents gave lower priority to their leadership role (14%); and only one respondent viewed her role as including providing psychological care (1%).

Table 3: 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 for patients	33	38.4%
Triage	22	25.6%
Resuscitation	18	20.9%
Leadership	12	14.0%
Psychological care	1	1.2%

Table 4: Level of understanding of the role of emergency nurses in mass-gathering disasters among study participants (n=106) (%)

Role variables	Strongly disagree	Disagree	Neither	Agree	Strongly agree	Total Agree
Emergency nurses are confident and knowledgeable in effectively responding to a mass-gathering disaster	0.0	1.9	12.4	38.1	47.6	**85.7**
Emergency nurses are key players in a mass-gathering disaster.	0.0	5.7	11.4	38.1	44.8	**82.9**
The main role of emergency nurses during disasters is to provide general assessment and caring for patients	2.8	1.9	13.2	41.5	40.6	**82.1**
The main role of emergency nurses during disasters is to provide general assessment and caring for patients	2.8	1.9	13.2	41.5	40.6	**82.1**
Emergency nurses are able to provide timely response to emergency situations.	1.0	5.8	13.5	35.6	44.2	**79.8**
The main role of emergency nurses during disasters is to provide resuscitation.	1.0	6.7	17.3	28.8	46.2	**75.0**
The main role of emergency nurses during disasters is to provide triage and initial consultation.	2.9	7.6	16.2	39.0	34.3	**73.3**
During mass-gathering disasters emergency nurses are responsible for clinical response.	1.0	4.8	21.0	45.7	27.6	**73.3**
Emergency nurses can effectively communicate with patients, families and other clinicians to provide therapies during emergency situations.	2.8	5.7	19.8	34.9	36.8	**71.7**
During mass-gathering disasters emergency nurses are responsible for surveillance.	1.9	13.6	18.4	42.7	23.3	**66.0**
During mass-gathering disasters emergency nurses are responsible for prevention.	2.9	13.3	20.0	40.0	23.8	**63.8**
The main role of emergency nurses during disasters is to act as team leaders.	1.9	16.0	22.6	34.0	25.5	**59.4**
The main role of emergency nurses during disasters is to provide psychological care.	5.7	16.2	27.6	30.5	20.0	**50.5**

As summarised in Table 4, most Emergency Nurses in Mecca's public hospitals appeared to be confident and knowledgeable about their roles to respond effectively to mass-gathering disasters, they reported seeing their main role as providing general assessment and care, with a timely response, including resuscitation, triage and initial consultation, and most reported to communicate well with others during emergency situations; however, fewer Emergency Nurses' see their role as providing surveillance, prevention, leadership, or psychological care in a mass-gathering disaster.

Disaster Education and Training

All respondents indicated they had received some form of disaster education and training. However, the recency of this training varied substantially, which is an important factor to bear in mind given that Hajj is an annual event in Mecca; only 34% attended training 6-12 months ago, 23% attended it 12-24 months ago, and 43% attended such training over 2 years ago.

Emergency nurse respondents indicated that the top three most beneficial types of education and training courses, which can help them to prepare for disaster events, were: (1) hospital education sessions suggested by 43% of respondents. Hospital education sessions involve free courses provided by the Training and Education Centers in Saudi hospitals; (2) the Emergency Management Saudi Course and Workshop suggested by27% of respondents. The Saudi Emergency Management course is delivered in Mecca and provides special training for emergency nurses over2-3 days to help them improve their knowledge and prepare for the Hajj event; (3) short courses in disaster management which were suggested by one in ten participants (11% of respondents). These are courses provided by private organizations.

In contrast, university training in disaster management was perceived as important by only a minority of respondents (8%), as was online education about disaster management (6%) and self-learning (3%).

Level of Awareness of the Hospital Department's Major Incident Plan

A major incident plan is a contingency plan prepared by the hospitals' departments, which details the critical procedures to be followed in the case of unexpected incidents. Almost half of the Emergency Nurses (47.1%) read their department's major incident plan thoroughly. However, just under one-quarter of the nurses (23%) have only flicked through it, and over one-fifth of them (21.8%) have not read it. Moreover, 8% of them didn't know they had one. To be fully prepared for a mass-gathering disaster, all emergency nurses should thoroughly read their department's major incident plan. However, the findings in this study suggest that over half (52.8%) of the emergency nurses in Mecca's public hospitals have not thoroughly read the plan, and some of them were not even aware of its existence. This suggests 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 considerably impact on staffs' stress levels following a major incident and put patients' safety at risk.

Previous Disaster Response Experience

Almost all (99%) of the respondents had previous experience of some type of disaster response. Figure 1 illustrates the frequency and range of previous disaster experiences among the study participants;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.

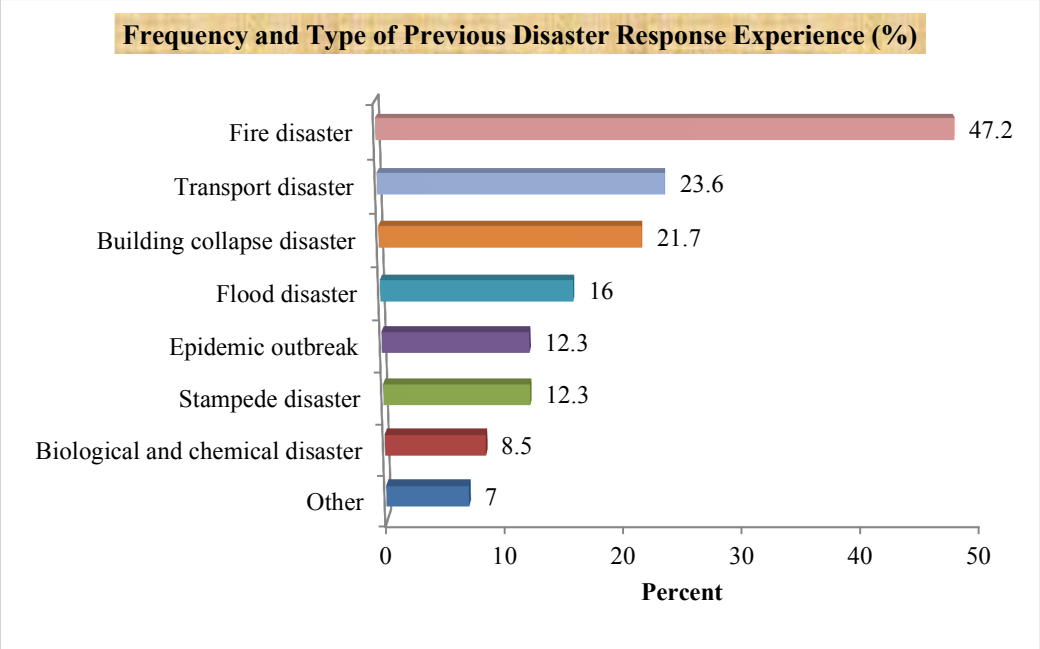

Figure 1: Previous disaster response experience of emergency nurses (N=86) respondent (%).

A Chi-square analysis examined the relationships between clinical positions, years of experience and previous disaster response experience and found that specialist nurses are more likely to have previous disaster response experience, than other nurses; specifically, 71% of nursing specialists had previous disaster response experience, as compared with nursing aids (25%) and nursing technicians (48.9%). This difference was statistically significant, $X^2(3) = 8.373$, p=0.039.

DISCUSSION

Level of Awareness and Knowledge to respond to a MG disaster reported by Emergency Nurses in Public Hospitals in Mecca

Disaster knowledge and awareness is a critical component in relation to the preparedness of Saudi nurses for mass gatherings and is a declared priority for the Kingdom of Saudi Arabia Ministry of Health (Shafi et al., 2008; Tawfiq and Memish, 2014). According to Tawfiq and Memish (2014), during Hajj, twenty four committees are tasked with the responsibility of promoting awareness and effective communication in preparation for disaster events. For example, the Supreme Hajj Committee, and the Hajj Preventive Medicine Committee undertake preventive measures prior to, during, and after the Hajj (Khan and McLeod, 2012). Information regarding estimated imminent disasters or with high likelihood of occurring is collected and shared by the Kingdom of Saudi Arabia Ministry of Health and the World Health Organization. Despite significant country investment in preparing an extensive communication and knowledge dissemination infrastructure in this field, Emergency Nurses who participated in this study reported low levels of knowledge and awareness about effective disaster response in mass gathering events, such as the Hajj pilgrimage. This finding signals the need for improvement in this area, including effective reach-out communication strategies and training targeting nurse practitioners, which currently appear to be substandard.

Disaster Education and Training

Education and training on disaster preparedness varied significantly by the clinical post that the nurses in our sample held. Involvement in disaster exercises needs to become more standardized and inclusive for all nursing grades in the emergency

department, in particular targeting the less senior roles of nursing aids and nursing technicians.

The findings also indicate that the Kingdom of Saudi Arabia Ministry of Health has undertaken extensive education and training programs for Emergency Nurses and this seems to have had some impact, since almost nine out of ten nurses in our sample reported participation in related education and training events.

One of the key developments with regards to education and training for Saudi Emergency Nurses is the emergence of the specialist field of 'Hajj Medicine'. According to Shafi et al. (2008), this nascent field of applied clinical practice 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 their wide participation in training activities and the 'hands-on' knowledge and skills gained from previous clinical experience during Hajj.

Previous Disaster Response Experiences for Emergency Nurses

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 the 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 (Ahmed, 2009; Tawfiq and Memish, 2014).

It is noted that some Saudi emergency nurses lack previous first-hand experience in disaster management. However, it is apparent that the level of exposure to mass gatherings is considerably higher in Saudi Arabia than in most countries. According to Hammad 2011, South Australian Emergency Nurses have limited immediate experience in responding to emergencies from prior participation in mass gathering events. According to Shafi et al. (2008), Saudi public health officials and health workers, together with policy makers, have seasoned experience and expertise in relation to disaster preparedness and management. The experience stems from the seasonal Hajj occurrence and from other regular gatherings taking place regularly in this particular setting.

Overall, the findings from this study on the roles of the Saudi ENs in Mecca, especially those in the ED, suggest that these nurses perform a wide range of clinical activities, in addition to the conventional ones, such as general assessment and caring of patient, triage, resuscitation, leadership and psychological care. However, the nurses' responses seem to have placed less emphasis on the domains of leadership and psychological care, revealing a narrow clinical focus on physical health.

CONCLUSION

This paper explored the critical factors influencing Emergency Nurses' responses during mass gatherings in Mecca, including their knowledge, perceived roles, education/training needs, and previous disaster experience. The findings from this study highlight a wealth of training that these nurses are involved in and the substantial experience that the nurses reported to have gained through clinical engagement in prior mass gathering events. Nonetheless, the findings also point to a worrying deficit in knowledge for Emergency Nurses in public hospitals in Mecca.

This study provides a good understanding of the role, though not capacity, that emergency nurses are expected to play. It also highlights their reluctance to become involved in leading during a disaster response, and providing psychological care. Nonetheless, these are essential skills for every individual nurse, who may be called on to make decisions or to support psychologically patients who are affected by stress, panic and/or trauma during the disaster. The emergency nurses should be engaged in a wide range of activities geared at assisting members of the public. The aim is to ensure that the practitioners are able to undertaking their responsibilities by acquiring the necessary skills. Hospital, online and university training courses and workshops, must include a specific focus on disaster response for Hajj and also cover content in the above seemingly neglected areas of clinical practice. The responsibility for this undertaking should be overseen by the policy-makers.

The majority of study participants reported that they can effectively communicate with patients, families and other clinicians during emergency situations. Yet, almost one in three Emergency Nurses reported that they feel they require training to improve these communication skills through, for example, role play and mentoring.

In terms of training and educational initiatives proposed by the respondents, the majority of Emergency Nurses in this study find hospital education sessions most beneficial, followed by Emergency Management Saudi Course and workshop, and short courses in disaster management. Therefore, these course training formats should be further developed and expanded to ensure that all emergency nurses attend frequently (at least once per year). Secondly, approximately one-fifth of the emergency nurses are willing to self-learn and use online education about disaster management, which they find beneficial. The online format is very promising, as it can be deployed to all nursing students with access to the internet (via smart phone, table, and personal computer). The policy makers and nursing educationists should tap into these avenues of increasing competency among nurses in responding to and managing disasters.

Involvement in disaster exercises during emergency nurses' current employment needs to be increased, as 18.4% of the study participants have never been involved in disaster exercises, and 40.2% of them were involved only once. This study did not explore differences in hospital training and exercises across the four hospitals. This is a possibility, and warrants future research (e.g., case study or comparative research), which might explain the variation in frequency of disaster education, training and exercise involvement among the study participants. Policy makers could consider initiating further research programs in this area. On their part, educationists could also initiate such programs to ensure that the relevant information with regards to disaster management is made available widely, especially amongst frontline practitioners.

Limitations and Suggestions for Future Research

A limitation of this study is the cross-sectional design, which provides a 'snapshot' of Emergency Nurse's responses, at one moment in time. Second, this study included the responses by Emergency Nurses, but it is also important to survey and interview other clinicians, such as doctors and paramedics, who play an equally crucial role in reducing casualties at Hajj, and other MG disaster events. Finally, the relatively small sample size (N=106), non-random sample, and single setting (Mecca's all four public hospitals) mean the results can only be generalized to other regions of Saudi Arabia and beyond with great 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.

Contributorship statement

Fuad Alzahrani conceived the study and acquired the data. He drafted the work and approves the final version submitted for publication. He agrees to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Dr Yiannis Kyratsis offered substantial contribution to the design, analysis and interpretation of data for the work. He revised the work critically for important intellectual content. He approves the approves the final version submitted for publication and agrees to be accountable for all aspects of the work in ensuring that

questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Competing interests

Fuad Alzahrani works as an Emergency Nurse at the King Fisal Hospital in Mecca Saudi Arabia. He received a graduate Scholarship Grant by the Saudi Arabian Ministry of Health.

Dr Yiannis Kyratsis has no competing interests to declare.

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Data sharing statement

Additional unpublished data from the study are available in the MSc Dissertation document titled: "Nurse Emergency and Disaster Preparedness during Mass Gatherings: a cross-sectional survey in public hospitals in Mecca, Saudi Arabia" City University London 2015

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Emergency Nurse Disaster Preparedness during Mass Gatherings: a cross-sectional survey in hospitals in Mecca, Saudi Arabia

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Emergency Nurse Disaster Preparedness during Mass Gatherings: a cross-sectional survey in hospitals in Mecca, Saudi Arabia

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ABSTRACT

Objectives: To assess hospital Emergency Nurses' self-reported knowledge, perceived role awareness and skills in disaster response with respect to the Hajj mass gathering in Mecca.

Design: Cross-sectional survey with primary data collection and non-probabilistic purposive sample conducted in late 2014.

Setting: all four public hospitals in Mecca Saudi Arabia.

Participants: 106 registered nurses in hospital emergency departments.

Main outcome measure: awareness, knowledge, skills, and perceptions of Emergency Nurses in Mecca with regards to mass gathering disaster preparedness.

Results: Although Emergency Nurses' clinical role awareness in disaster response was reported to be high, nurses reported limited knowledge and awareness of the wider emergency and disaster preparedness plans, including key elements of their hospital strategies for managing a mass gathering disaster. Over half of the ENs in Mecca's public hospitals had not thoroughly read the plan, and almost one in ten were not even aware of its existence. ENs' knowledge was lowest for coping with chemical biological radiological incidents, and highest for the handling of emergency room disaster casualties arriving via the Saudi Red Crescent. Respondents identified three key training initiatives as opportunities to further develop their professional skills in this area: a) hospital education sessions, b) the Emergency Management Saudi Course, c) bespoke short courses in disaster management.

Conclusion: Recommendations are suggested to help enhance clinical and educational efforts in disaster preparedness.

Strengths and Limitations of this Study

This paper adds to the emerging body of knowledge on the role of Emergency Nurses' in responding to mass gathering disasters, being the first study to report empirical findings on this important topic in Saudi Arabia and the city of Mecca. The results from this study report on the perceived preparedness of Emergency Nurses for disaster response during the Hajj mass gathering against standards for this role as stated in the emergency plans of local hospitals. In addition, this study suggests specific educational efforts to help improve the professional skill of the nurse workforce in this important area of clinical practice.

Limitations of this study include its cross-sectional design, the relatively small sample size, the use of non-random sampling, and reporting evidence from one geographic area.

Keywords: Emergency Nursing, Mass gathering, Hajj, Disaster Preparedness, Saudi Arabia

Word Count: (3841).

INTRODUCTION

Background

Despite the central role of frontline nursing staff in hospital Emergency Departments (ED) in responding to disasters, little is known about the knowledge and skill required by this group of health professionals to effectively carry out this important clinical role. In particular, there is a paucity of studies that directly measure aspects of disaster preparedness for Emergency Nurses (ENs) in the context of mass gatherings (MGs) [1, 2, 3]. Furthermore, there is an absence of studies on assessing emergency nurses' perceived knowledge and role awareness in disaster response in Saudi Arabia, a country which hosts annually one of the world's largest mass gathering.

The World Health Organization (WHO) defines disaster as *"an occurrence disrupting the normal conditions of existence and causing a level of suffering that exceeds the capacity of adjustment of the affected community"* [4]. In Addition, Kaji *et al* (2006) [5], defined disaster as *"a natural or man-made event that results in an imbalance between the supply and demand for resources"*[6]. Mass gatherings (MGs) are variously described in the literature with no widely agreed definition. Most researchers agree that MGs are events attended by a large number of people (i.e. over 1,000) at a specific location, for a defined period of time [7, 8]. Hammad *et al*. 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"* [1]. In addition to straining the planning and response resources of the host country, MGs also pose special risks for attendees. Common risks include injuries and accidents, stampede, spread of infectious diseases, and terrorism among others [8, 9]. The risk of a catastrophic incident occurring during mass gatherings also presents particular challenges in the prevention, harm minimization, and emergency response of healthcare facilities. The distinctive features of mass gatherings that can affect public health and safety services include their wide geographical spread, large levels of attendance, their duration and the security concerns that they present. For health care services the main objective during MGs is to prevent or minimize the risk of injuries or illnesses and maximize the safety of participants [1, 9, 10].

In the case of an emergency arising from any of the above risks, there will be a strain in the local healthcare facilities. Therefore, the nurses at EDs in hospitals should be adequately

trained and prepared for such eventualities to provide for an effective response and help in reducing the number of potential fatalities [5]. In particular, nurses working in EDs must have the essential knowledge, skills and experience to efficiently manage emergencies and cope with often chaotic circumstances accompanying a disaster.

An ascent body of literature informed by empirical work in emergency nursing disaster preparedness has started emerging, in particular in the context of MGs. Hammad *et al*. [1] in a mixed methods study reported on the knowledge and perceptions of emergency nurses in South Australia on their role in disaster preparedness. Alexander [11] explored the beliefs in common myths held by Massachusetts University students and three groups of trainee emergency workers in Italy. The research revealed that the participants held various misconceptions regarding disaster management. Magnaye *et al.* [2] sought to determine the opinions held by emergency nurses in Philippines with regards to their role in disaster management. The research also examined their preparedness and levels of their skills in response to disasters.

Studies in this area suggest that a number of factors influence the ability of hospital nurses to respond to a disaster, particularly during MGs. Disaster education and training is a key element [12]. Drills and exercises, as well as military training and postgraduate taught studies focusing on disaster response, constitute important aspects of education and training efforts. Nonetheless, there is less agreement in the literature regarding the content and the mode of delivery of such education programs. In addition, the relevance of existing programs to nursing professionals in EDs is questioned [5, 10, 13].

A second important factor influencing the effectiveness of Emergency Nurses' response, particularly in the context of MGs, is their level of knowledge and awareness of the appropriate course of action [1, 11, 14]. Welzel and colleagues [15] argue for the necessity of early communication of relevant information to ENs, which provides them with the opportunity to simulate their response, thus increasing their response capability.

Prior disaster management experience constitutes a third key factor in relation to ENs' preparedness in MG disasters [16]. Welzel *et al*. [15] argue that experience can be gained for nurses coming from societies where disasters are uncommon by volunteering to practice in societies more prone to disasters; 'hands on' education and field training in this context can support ENs gaining valuable experience in disaster preparedness [1, 7, 9, 17]. Finally, there is a reported need for collaboration and communication between the different professionals

involved in the provision of care in emergency departments, including nurses, physicians, the management team, and support staff [18].

Study objectives

This study aims to contribute to our understanding of emergency nursing and disaster response preparedness in MGs. This study was designed to specifically assess the self-reported knowledge and perceived disaster preparedness in relation to the annual Hajj pilgrimage of registered nurses currently working in the emergency departments of all public hospitals in Mecca. Hajj refers to the Muslim pilgrimage to Mecca in Saudi Arabia, performed annually by more than two million people originating from more than 140 countries globally [10, 19, 20]. The Hajj constitutes the largest annual MG in the world [18].

The study had three key objectives:

1. To assess the level of awareness and self-reported knowledge in disaster response of the Emergency Nurses working in public hospitals in Mecca.
2. To assess the current roles and skills in disaster preparedness during the Hajj mass gathering as reported by the Emergency Nurses included in our study, in particular against existing standards and plans in their hospitals.
3. To identify the type of training programs and education deemed appropriate and relevant by the Emergency Nurses studied.

METHODS

Study design

A cross-sectional online survey was selected as the most appropriate research design for the purpose of the study [21]. 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. Online survey administration provides convenience for busy professionals, such as nurses, to complete the questionnaire in their own time. Although the researcher being absent reduces control, it increases anonymity for participants, encouraging them to give more honest responses.

Study site and population

The setting for this study included all four public hospitals in Mecca, Saudi Arabia. Mecca was purposefully selected as the Hajj MG is held there annually, thereby increasing the potential risk for a disaster to occur in that locality [11, 12, 14, 16]. We used non-probability purposive sampling [22]. The target study population consisted of all registered nurses working in the EDs of all four public hospitals in Mecca (N=350). Registered ENs work in critical care emergency facilities as part of a team with physicians, other nurses and allied health professionals to provide care, monitor health conditions, plan long-term care needs, administer medicine, use medical equipment, perform minor medical operations, and advise patients and their families on illness, care and follow on care after a hospital stay. The emergency preparedness plans during the Hajj for the four hospitals in Mecca state that the role of all types of ENs' include the following five key clinical tasks: a) provision of general assessment and care for patients, b) triage of incoming patients, c) performing resuscitation if needed, d) demonstrating clinical leadership, and e) providing psychological care to patients. These key clinical tasks have been assessed in our questionnaire. Registered ENs in Saudi Arabia who are expected to perform the above tasks can be: (1) nursing technicians, who have a high diploma in nursing, (2) nursing specialists, who have bachelor's degrees in nursing, or (3) a nurses' aides, who have attended a course for one year in nursing. Participation in this study was voluntary and 106 ENs returned completed questionnaires (30% response rate). ENs participating in the study were primarily either nursing technicians or specialists (90% or 76/84 of those who provided a response about their current clinical position).

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 and spontaneous responses respectively and to allow respondents provide more in-depth information, where appropriate [22]. 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 development of the questionnaire's content was informed by similar studies [1, 2, 11]. The questionnaire used in the current study borrowed extensively from the questions posed by the researchers in the studies enumerated above. The content was further adapted to

include key clinical tasks described in the hospital emergency preparedness plans as advised by local experts during the pilot study. Consequently, the tool analysed the self-reported knowledge, skills, and perceptions of ENs in Mecca with regards to disaster preparedness, including EN's awareness of the standards for their roles as outlined in the Major Incident plans of the four hospitals in Mecca. In this study, the questionnaire included 18 questions, which were divided into five sections: (1) Knowledge and Awareness in relation to disaster preparedness. This section of the questionnaire addressed this aspect of the study by contextualising disaster response in the hospital setting in Mecca. The responses of the participants were measured in a 5-Point Likert Scale (1 for Strongly Agree and 5 for Strongly Disagree). (2) Roles of nurses in disasters. This section comprised 12 items, which were measured in a 5-Point Likert Scale and focused on the role of nurses in providing care, psychological assistance, and triage, also as delineated in local hospital emergency and disaster preparedness plans (i.e the Major Incident plans). (3) Education and training; four items were designed to identify types of disaster education and training available and perceived as relevant by the ENs in hospitals in Mecca. (4) Previous experience on disaster response; nine items explored respondents' involvement in disaster management in the past. (5) The fifth section of the questionnaire explored the demographics of the participants.

Ethics approval

The School of Health Sciences Research Ethics Committee, City University London and the Ministry of Health in Saudi Arabia and the R&D departments of the participating hospitals approved the study. All participants provided informed consent.

Data collection

The questionnaire was initially piloted with ENs in the hospital the first author is employed. The pilot group was then broadened to also include local experts and hospital staff from other hospitals. Specifically the pilot group comprised faculty members from King Abdulaziz University, School of Nursing (one male and one female), two members of the management staff (one male and one female) in two of the selected public hospitals, and five nurses (three females and two males) from the ED of the public hospitals selected for the study. It is important to note that the two faculty members were not drawn from the study population. On the contrary, they were experts in the field of nursing research. The aim of using them was to determine the suitability and adequacy of the questionnaire to the current study given their experience in this field. On their part, the management staff and ENs were involved to ensure that the participants could understand the questions posed in the survey and that the survey

was realistic, feasible and workable to execute within a reasonable timeframe. The experts suggested some adjustments in language used on the items to make them specific to the field of emergency nursing in Saudi Arabia. The management team and ENs suggested merging some questions to reduce the time needed to complete the survey. The revised questionnaire following the pre-test took an average of 10 to 15 minutes to complete.

The questionnaire was made available in English language. Forward and backward translations to the Arabic language were conducted by two bi-lingual ENs during the piloting stage. The importance of having an English language translation was due to the fact that the majority, 53.1% in 2009, of nurses working in public hospitals in Saudi Arabia are non-Saudi nationals [23]. Also all nurses in the emergency departments in the hospitals studied were fluent English speakers. 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 in September 2014. Participation by respondents was voluntary.

Data analysis

The survey data collected was analyzed quantitatively using the statistics analysis software 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, frequencies counts and percentages, and crosstabs with the Chi-square statistic. Charts and figures were produced to facilitate understanding and comparisons, where appropriate. Statistical significance was defined as $p<.05$ for all statistical tests.

RESULTS

Respondents' Demographic Characteristics

Table 1 summarizes the demographic characteristics of the respondents. The majority were aged between 20 and 40 years. There were more male (52.8%) than female nurses (24.5%), although 22.6% of the respondents declined to specify gender. Over half of the respondents were employed as either nursing technicians or nursing specialists (42.5% and 29.2%, respectively, or 53.6% and 36.9% respectively of those who answered this question); few were nursing aids (3.8%). About 52% of the respondents reported 0-5 years' experience in

ED, followed by 6–10 years for 32.9%, and 11.0% with 11–15 years. Most respondents had worked in the field of emergency nursing for 0–5 years and 6–10 years (43.4% and 21.7%, respectively); 12.2% of the respondents had over 10 years' field experience, of which 2.8% of respondents had over 20 years' experience.

Table 1: Demographic characteristics of 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
Years of work in current emergency department		
0–5	43	52.4
6–10	27	32.9
11–15	9	11.0
16–20	1	1.2
More than 20	2	2.4
Years of work in the field of emergency nursing		
0–5	46	43.4
6–10	23	21.7
11–15	8	7.5
16–20	2	1.9
More than 20	3	2.8

Emergency Nurses' Disaster Knowledge and Awareness

The reported knowledge of disaster preparedness by ENs was surprisingly very low. Table 2 shows the responses to the 'knowledge assessment test' on topics where there are often misconceptions on appropriate management of disaster. Only one in three of the respondents (34.3%) correctly responded that most casualties from a disaster arrive to EDs via the Saudi Red Crescent. Saudi Red Crescent (SRC) is "a humanitarian society that provides emergency medical services in all regions of the Kingdom of Saudi Arabia. It was founded in 1963" [24]. A key function of the SRC is to transport patients to EDs and also provide emergency medical services and emergency food supplies in disasters. It also contributes to raising the level of health awareness in the country. Similarly, only 32% of ENs correctly responded that disease epidemics are an almost inevitable result of the disruption and poor health caused by major disasters; only 29.1% were mindful that the poor are more at risk of death than rich people or the middle classes during a disaster; only one in five (20.6%) correctly responded that un-buried dead bodies would not create a disease epidemic following an MG disaster; and only one in six (16.3%) responded correctly that all victims of a chemical biological radiological (CBR) incident will have dangerous substances removed at the scene of an incident prior to their arrival to hospital. These findings demonstrate a significant deficit in Emergency Nurse's reported knowledge and awareness to effectively respond to disaster within all Mecca's public hospitals.

Table 2: Respondents 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	34.3%
Disease epidemics are an almost inevitable result of the disruption and poor health caused by major disasters	33	32.0%
The poor are more at risk of death than rich people or the middle classes during a disaster	30	29.1%
Un-buried dead bodies will not create a disease epidemic following a mass gathering disaster	21	20.6%
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	16.3%

The Role of Emergency Nurses during MGs

Table 3 presents the ENs' perceptions of their role during the Hajj mass gathering. Respondents perceived their dominant role as providing general assessment and caring for patients (38%), followed by triage (26%) and resuscitation (21%); whereas the respondents gave lower priority to their leadership role (14%); and only one respondent viewed her role as including providing psychological care (1%).

Table 3: 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 for patients	33	38.4%
Triage	22	25.6%
Resuscitation	18	20.9%
Leadership	12	14.0%
Psychological care	1	1.2%

Table 4: Level of understanding of the role of emergency nurses in mass gathering disasters among study participants (n=106) (%)

Role variables	Strongly disagree	Disagree	Neither	Agree	Strongly agree	Total Agree
Emergency nurses are confident and knowledgeable in effectively responding to a mass gathering disaster	0.0	1.9	12.4	38.1	47.6	**85.7**
Emergency nurses are key players in a mass gathering disaster	0.0	5.7	11.4	38.1	44.8	**82.9**
The main role of emergency nurses during disasters is to provide general assessment and caring for patients	2.8	1.9	13.2	41.5	40.6	**82.1**
Emergency nurses are able to provide timely response to emergency situations	1.0	5.8	13.5	35.6	44.2	**79.8**
The main role of emergency nurses during disasters is to provide resuscitation	1.0	6.7	17.3	28.8	46.2	**75.0**
The main role of emergency nurses during disasters is to provide triage and initial consultation	2.9	7.6	16.2	39.0	34.3	**73.3**
During mass gathering disasters emergency nurses are responsible for clinical response	1.0	4.8	21.0	45.7	27.6	**73.3**
Emergency nurses can effectively communicate with patients, families and other clinicians to provide therapies during emergency situations	2.8	5.7	19.8	34.9	36.8	**71.7**
During mass gathering disasters emergency nurses are responsible for surveillance	1.9	13.6	18.4	42.7	23.3	**66.0**

During mass gathering disasters emergency nurses are responsible for prevention	2.9	13.3	20.0	40.0	23.8	**63.8**
The main role of emergency nurses during disasters is to act as team leaders	1.9	16.0	22.6	34.0	25.5	**59.4**
The main role of emergency nurses during disasters is to provide psychological care	5.7	16.2	27.6	30.5	20.0	**50.5**

As summarised in Table 4, most ENs in Mecca's public hospitals appeared to be confident and knowledgeable about their roles to respond effectively to mass gathering disasters. They reported seeing their main role as providing general assessment and care, with a timely response, including resuscitation, triage and initial consultation, and most reported to communicate well with others during emergency situations; however, fewer ENs see their role as providing surveillance, prevention, leadership, or psychological care in a mass gathering disaster, despite all these roles being described in the standards of care of the hospitals' emergency plans in disaster response.

Disaster Education and Training

All respondents indicated they had received some form of disaster education and training. However, the recency of this training varied substantially, which is an important factor to bear in mind given that the Hajj is an annual event in Mecca; only 34% had attended training in the last 6-12 months, 23% attended it in the last 12-24 months, and 43% attended such training over 2 years ago.

EN respondents indicated that the top three most beneficial types of education and training courses for disaster response preparedness were: (1) Hospital education sessions, which were suggested by 43% of respondents. Hospital education sessions involve free courses provided by the Training and Education Centers in Saudi hospitals. (2) The Emergency Management Saudi Course and Workshop, which was suggested by 27% of respondents. The Saudi Emergency Management course is delivered in Mecca and provides special training for ENs over 2-3 days to help them improve their knowledge of handling emergencies in preparation for the Hajj. (3) Short courses in disaster management, which were suggested by one in ten participants (11% of respondents). These are courses provided by private organizations.

In contrast, university training in disaster management was perceived as important by only a minority of respondents (8%), as was online education about disaster management (6%) and self-learning (3%).

Level of Awareness of the Hospital Department's Major Incident Plan

A Major Incident Plan is a contingency plan prepared by the hospitals' departments, which details the critical procedures to be followed in the case of unexpected incidents. Almost half of the Emergency Nurses (47.1%) reported to have read their department's Major Incident Plan thoroughly. However, just less than one-quarter of the nurses (23%) reported that they had only flipped through it, and over one-fifth of them (21.8%) had not read it. Moreover, 8% of them didn't know they had one. To be fully prepared for a mass gathering disaster, all ENs are expected to thoroughly read their department's major incident plan. Nonetheless, over half (52.8%) of the ENs in Mecca's public hospitals had not thoroughly read the plan, and some of them were not even aware of its existence. This suggests 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 emergency department. This could considerably impact on staffs' stress levels following a major incident and put patients' safety at risk.

Previous Disaster Response Experience

Almost all (99%) of the respondents had previous experience of some type of disaster response. Figure 1 illustrates the frequency and range of previous disaster experiences among the study participants; almost one in two (47%) had experiences of a fire disaster, one in four (24%) of a transport disaster, just over one in five (21.7%) of a building collapse, one in six (16%) of a flood, almost one in eight (12.3%) of a stampede, or an epidemic outbreak, and one in ten (9%) of a biological and chemical disaster.

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

A Chi-square analysis examined the relationships between clinical positions, years in clinical practice and previous disaster response experience and found that specialist nurses are more

likely to have previous disaster response experience, than other types nurses; specifically, 71% of nursing specialists had previous disaster response experience, as compared with nursing aids (25%) and nursing technicians (48.9%). This difference was statistically significant, $X^2(3) = 8.373$, p=0.039.

DISCUSSION

Level of Awareness and Knowledge to respond to a MG disaster reported by Emergency Nurses in Public Hospitals in Mecca

Disaster knowledge and awareness is a critical component in relation to the preparedness of Saudi nurses for MGs and is a declared priority for the Saudi Arabian Ministry of Health [10, 13]. According to Tawfiq and Memish [10], during the Hajj, twenty four committees are tasked with the responsibility of promoting awareness and effective communication in preparation for a mass gathering disaster. For example, the Supreme Hajj Committee, and the Hajj Preventive Medicine Committee undertake preventive measures prior to, during, and after the Hajj [25]. Information regarding estimated imminent disasters or with high likelihood of occurring is collected and shared by the Saudi Arabian Ministry of Health and the World Health Organization. Despite significant national investment in preparing an extensive communication and knowledge dissemination infrastructure in this field, ENs who participated in this study reported low levels of knowledge on effective disaster response to the Hajj pilgrimage mass gathering. This finding signals the need for substantial improvement in this area, including effective reach-out communication strategies and training targeting nurse practitioners, which currently appear to be substandard.

Disaster Education and Training

Education and training on disaster preparedness varied significantly by the clinical post the nurses in our sample held. Involvement in disaster exercises needs to become more standardized and inclusive for all nursing grades in the emergency department, in particular targeting the less senior roles of nursing technicians and nursing aids.

The Saudi Arabian Ministry of Health has undertaken extensive education and training programs for ENs and this was somehow reflected in our participants' responses, since

almost nine out of ten nurses in our sample reported participation in related education and training events.

One of the key developments with regards to education and training for Saudi ENs is the emergence of the specialist field of 'Hajj Medicine'. According to Shafi *et al*. [13], this nascent field of applied clinical practice entails management and control of emerging and common health problems during the Hajj. What makes the Hajj so unique for education and training in MGs is that it is the oldest studied MG in the modern world, with reports on the medical management of disease outbreaks published since the 1800s [26]. Saudi ENs can extent their 'hands-on' practice experience by reflecting more systematically on this body of codified knowledge and the lessons learned from many years of effective public health surveillance in the challenging setting of one of world's largest MG.

Previous Disaster Response Experiences for Emergency Nurses

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 the Saudi public health authorities' exemplary management of communicable diseases in MGs. The WHO [4] based their praise on the high level of experience among health workers and their previous undertakings during the Hajj pilgrimage [10, 27].

It is noted that some Saudi ENs lack previous first-hand experience in disaster management. However, it is apparent that the level of exposure of ENs to challenging conditions associated with MGs is considerably higher in Saudi Arabia than in most countries. According to Hammad *et al.* [1], South Australian Emergency Nurses have limited immediate experience in responding to emergencies from prior participation in MG disasters. According to Shafi et al. [13], Saudi public health officials and health workers, together with policy makers, have seasoned experience and expertise in relation to disaster preparedness and management. The experience stems from the seasonal Hajj occurrence and from other gatherings taking place regularly in the locality.

The majority of study participants reported that they can effectively communicate with patients, families and other clinicians during emergency situations. Yet, almost one in three ENs reported that they feel they require training to improve these communication skills through, for example, role-play, tabletop drills, or mentoring.

In terms of training and educational initiatives proposed by the respondents, the majority of ENs in this study find hospital education sessions most beneficial, followed by the Emergency Management Saudi courses in disaster management. Therefore, these course training formats should be further developed and expanded to ensure that all emergency nurses attend frequently (at least once per year). Secondly, approximately one-fifth of the emergency nurses are willing to self-learn and use online education about disaster management, which they find beneficial. The online format is very promising, as it can be deployed to all nursing students with access to the Internet (via smart phones, tablets, and personal computers). The policy makers and nursing educationists should tap into these avenues of increasing competency among nurses.

Overall, the findings from this study on the roles of the Saudi ENs in Mecca, suggest that these nurses are expected to perform a wide range of clinical activities outlined in the Major Incident Plans of local hospitals. Such clinical activities include prevention, surveillance, general assessment and caring of patient, triage, resuscitation, leadership and psychological care. However, judging from the nurses' responses to our questionnaire, ENs appear to put less emphasis on the domains of leadership and psychological care, revealing a rather narrow clinical focus on physical health. They also seem to be geared towards the clinical tasks of acute care provision rather than the more proactive clinical activities of surveillance and prevention.

CONCLUSION

This study sheds some light to provide a better understanding of the role, though not capacity, that ENs in Mecca are expected to play in disaster preparedness during the Hajj MG. The findings from this study suggest that despite the substantial experience gained through clinical engagement in prior MGs, there is a worrying deficit in knowledge of the Major Incident Plans for ENs working in public hospitals in Mecca. The findings also suggest that ENs' seem to be reluctant to undertake a leading role during a disaster response, and to provide preventive and psychological care. Nonetheless, these are essential skills for every individual nurse, who may be called on to make decisions or to support psychologically patients who are affected by stress, panic and/or trauma during the disaster.

The ENs are expected to be engaged in a wide range of activities geared at assisting members of the public. Hospital, online, and university-based training courses, and workshops, must include a specific focus on disaster response for Hajj and also cover content in the above seemingly neglected areas of clinical practice. The responsibility for this undertaking needs to be overseen by both the local and national-level policy-makers, with potential involvement of the WHO.

Involvement of ENs in disaster exercises needs to be encouraged and further supported by hospital management and the Ministry of Health, as one in five study participants reported that they have never been involved in disaster exercises, and four out of ten reported to have been involved only once. This study did not explore differences in hospital training and exercises across the four hospitals. This is a possibility, and warrants future research, which might explain the reported variation in frequency of disaster education, training, and exercise involvement among the study participants.

Limitations and Suggestions for Future Research

A limitation of this study is the cross-sectional design, which provides a 'snapshot' of ENs' responses, at one moment in time. Second, this study included the responses by ENs, but it is also important to survey and interview other clinicians, such as doctors and paramedics, who play an equally crucial role in reducing fatalities at Hajj, and other MG disasters. Finally, the relatively small sample size (N=106), non-random sample, and single setting (Mecca's all four public hospitals), the relatively heterogeneous (three different nursing grades) and rather non-typical group of nurses participating in our study (half of the nurses in our sample being

trained abroad) mean the results can only be generalized to other regions of Saudi Arabia and beyond with great caution. A larger national survey of all ENs who have a role in MGs is needed, to gain a broad understanding of their knowledge, experience and training needs for disaster 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 nurse training to enhance patient safety.

Contributorship statement

Fuad Alzahrani conceived the study and acquired the data. He drafted the work and approves the final version submitted for publication. He agrees to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Dr Yiannis Kyratsis offered substantial contribution to the design, analysis and interpretation of data for the work. He revised the work critically for important intellectual content. He approves the final version submitted for publication and agrees to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Competing interests

Fuad Alzahrani works as an Emergency Nurse at the King Fisal Hospital in Mecca Saudi Arabia. He received a graduate Scholarship Grant by the Saudi Arabian Ministry of Health.
Dr Yiannis Kyratsis has no competing interests to declare.

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Data sharing statement

Additional unpublished data from the study are available in the MSc Dissertation document titled: "Nurse Emergency and Disaster Preparedness during Mass Gatherings: a cross-sectional survey in public hospitals in Mecca, Saudi Arabia" City University London 2015

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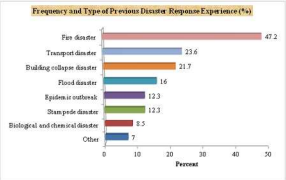
Frequency and Type of Previous Disaster Response Experience (%)
Fire disaster
47.2
Transport disaster
23.6
Building collapse disaster
21.7
Flood disaster
16
Epidemic outbreak
12.3
Stampede disaster
12.3
Biological and chemical disaster
8.5
Other
7
0
10
20
30
40
50
Percent

Figure1

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2-3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-6
Objectives	3	State specific objectives, including any prespecified hypotheses	6-7
Methods			
Study design	4	Present key elements of study design early in the paper	7
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	7 & 9
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	7-9
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	8
Bias	9	Describe any efforts to address potential sources of bias	9
Study size	10	Explain how the study size was arrived at	7-8
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	9-10
		(*b*) Describe any methods used to examine subgroups and interactions	9-10
		(*c*) Explain how missing data were addressed	20
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	n/a
		(*e*) Describe any sensitivity analyses	n/a
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	10-11
		(b) Give reasons for non-participation at each stage	n/a
		(c) Consider use of a flow diagram	n/a
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	10-11
		(b) Indicate number of participants with missing data for each variable of interest	10-14
Outcome data	15*	Report numbers of outcome events or summary measures	n/a
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	16
		(*b*) Report category boundaries when continuous variables were categorized	n/a
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	9-15
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	20
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	19-20
Generalisability	21	Discuss the generalisability (external validity) of the study results	20
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	23

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Emergency Nurse Disaster Preparedness during Mass Gatherings: a cross-sectional survey of Emergency Nurses' perceptions in hospitals in Mecca, Saudi Arabia

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Emergency Nurse Disaster Preparedness during Mass Gatherings: a cross-sectional survey of Emergency Nurses' perceptions in hospitals in Mecca, Saudi Arabia

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ABSTRACT

Objectives: To assess hospital Emergency Nurses' self-reported knowledge, role awareness and skills in disaster response with respect to the Hajj mass gathering in Mecca.

Design: Cross-sectional online survey with primary data collection and non-probabilistic purposive sample conducted in late 2014.

Setting: all four public hospitals in Mecca Saudi Arabia.

Participants: 106 registered nurses in hospital emergency departments.

Main outcome measure: awareness, knowledge, skills, and perceptions of Emergency Nurses in Mecca with regards to mass gathering disaster preparedness.

Results: Although Emergency Nurses' clinical role awareness in disaster response was reported to be high, nurses reported limited knowledge and awareness of the wider emergency and disaster preparedness plans, including key elements of their hospital strategies for managing a mass gathering disaster. Over half of the Emergency Nurses in Mecca's public hospitals had not thoroughly read the plan, and almost one in ten were not even aware of its existence. Emergency Nurses reported seeing their main role as providing timely general clinical assessment and care; however, fewer Emergency Nurses saw their role as providing surveillance, prevention, leadership, or psychological care in a mass gathering disaster, despite all these broader roles being described in the hospitals' emergency disaster response plans. Emergency Nurses' responses to topics where there are often misconceptions on appropriate disaster management indicated a significant knowledge deficit with only one in three at best or one in six at worse nurses giving correct answers. Respondents identified three key training initiatives as opportunities to further develop their professional skills in this area: a) hospital education sessions, b) the Emergency Management Saudi Course, c) bespoke short courses in disaster management.

Conclusion: Recommendations are suggested to help enhance clinical and educational efforts in disaster preparedness.

Strengths and Limitations of this Study

- This is the first empirical study on the role of Emergency Nurses in mass gathering disaster preparedness in Saudi Arabia and the city of Mecca.
- The study provides valuable new information on the perceived preparedness of Emergency Nurses during the Hajj mass gathering against role standards as stated in the emergency plans of local hospitals.
- The study identifies specific health education and training programs deemed appropriate and relevant by the Emergency Nurses.
- Limitations of this study include its cross-sectional design, the relatively small and non-random sample, and the use of self-reported data.

Keywords: Emergency Nursing, Mass gathering, Hajj, Disaster Preparedness, Saudi Arabia

Word Count: (4,923).

INTRODUCTION

Background

Despite the central role of frontline nursing staff in hospital Emergency Departments (ED) in responding to disasters, little is known about the knowledge and skill required by this group of health professionals to effectively carry out this important clinical role. In particular, there is a paucity of studies that directly measure aspects of disaster preparedness for Emergency Nurses (ENs) in the context of mass gatherings (MGs) [1, 2, 3]. Furthermore, there is an absence of studies on assessing Emergency Nurses' perceived knowledge and role awareness in disaster response in Saudi Arabia, a country which hosts annually one of the world's largest mass gatherings.

The World Health Organization (WHO) defines disaster as *"an occurrence disrupting the normal conditions of existence and causing a level of suffering that exceeds the capacity of adjustment of the affected community"* [4]. In Addition, Kaji *et al* (2006) [5] defined disaster as *"a natural or man-made event that results in an imbalance between the supply and demand for resources"* [6]. Mass gatherings (MGs) are variously described in the literature with no widely agreed definition. Most researchers agree that MGs are events attended by a large number of people (i.e. over 1,000) at a specific location, for a defined period of time [7, 8]. Hammad *et al*. 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"* [1]. In addition to straining the planning and response resources of the host country, MGs also pose special risks for attendees. Common risks include injuries and accidents, stampede, spread of infectious diseases, and terrorism among others [8, 9]. The risk of a catastrophic incident occurring during mass gatherings also presents particular challenges in the prevention, harm minimization, and emergency response of healthcare facilities. The distinctive features of mass gatherings that can affect public health and safety services include their wide geographical spread, large levels of attendance, their duration and the security concerns that they present. For health care services the main objective during MGs is to prevent or minimize the risk of injuries or illnesses and maximize the safety of participants [1, 9, 10].

In the case of an emergency arising from any of the above risks, there will be a strain in the local healthcare facilities. Therefore, the nurses at EDs in hospitals should be adequately

trained and prepared for such eventualities to provide for an effective response and help in reducing the number of potential fatalities [5]. In particular, nurses working in EDs must have the essential knowledge, skills and experience to efficiently manage emergencies and cope with often chaotic circumstances accompanying a disaster.

A nascent body of literature informed by empirical work in emergency nursing disaster preparedness has started emerging, in particular in the context of MGs. Hammad *et al*. [1] in a mixed methods study reported on the knowledge and perceptions of emergency nurses in South Australia on their role in disaster preparedness. Alexander [11] explored the beliefs in common myths held by Massachusetts University students and three groups of trainee emergency workers in Italy. The research revealed that the participants held various misconceptions regarding disaster management. Magnaye *et al.* [2] sought to determine the opinions held by ENs in Philippines with regards to their role in disaster management. The research also examined their preparedness and levels of their skills in response to disasters.

Studies in this area suggest that a number of factors influence the ability of hospital nurses to respond to a disaster, particularly during MGs. Disaster education and training is a key element [12]. Drills and exercises, as well as military training and postgraduate taught studies focusing on disaster response, constitute important aspects of education and training efforts. Nonetheless, there is less agreement in the literature regarding the content and the mode of delivery of such education programs. In addition, the relevance of existing programs to nursing professionals in EDs is questioned [5, 10, 13].

A second important factor influencing the effectiveness of ENs' response, particularly in the context of MGs, is their level of knowledge and awareness of the appropriate course of action [1, 11, 14]. Welzel and colleagues [15] argue for the necessity of early communication of relevant information to ENs, which provides them with the opportunity to simulate their response, thus increasing their response capability.

Prior disaster management experience constitutes a third key factor in relation to ENs' preparedness in MG disasters [16]. Welzel *et al*. [15] argue that experience can be gained for nurses coming from societies where disasters are uncommon by volunteering to practice in societies more prone to disasters; 'hands on' education and field training in this context can support ENs gaining valuable experience in disaster preparedness [1, 7, 9, 17]. Finally, there is a reported need for collaboration and communication between the different professionals

involved in the provision of care in emergency departments, including nurses, physicians, the management team, and support staff [18].

Study objectives

This study aims to contribute to our understanding of emergency nursing and disaster response preparedness in MGs. This study was designed to specifically assess the self-reported knowledge and disaster preparedness in relation to the annual Hajj pilgrimage of registered nurses currently working in the Emergency Departments of all public hospitals in Mecca. Hajj refers to the Muslim pilgrimage to Mecca in Saudi Arabia, performed annually by more than two million people originating from more than 140 countries globally [10, 19, 20]. The Hajj constitutes the largest annual MG in the world [18].

The study had three key objectives:

1. To assess the level of awareness and self-reported knowledge in disaster response of the Emergency Nurses working in public hospitals in Mecca.
2. To assess the current roles and skills in disaster preparedness during the Hajj mass gathering as reported by the Emergency Nurses included in our study, in particular against existing standards and plans in their hospitals.
3. To identify the type of training programs and education deemed appropriate and relevant by the Emergency Nurses studied.

METHODS

Study design

A cross-sectional online survey was selected as the most appropriate research design for the purpose of the study [21]. 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. Online survey administration provides convenience for busy professionals, such as nurses, to complete the questionnaire in their own time. Although the researcher being absent reduces control, it increases anonymity for participants, encouraging them to give more honest responses.

Study site

The setting for this study included all four public hospitals in Mecca, Saudi Arabia. Mecca was purposefully selected as the Hajj MG is held there annually, thereby increasing the potential risk for a disaster to occur in that locality [11, 12, 14, 16]. We used non-probability purposive sampling [22]. The target study population consisted of all registered nurses working in the EDs of all four public hospitals in Mecca (N=350).

Study population

Registered ENs in Saudi Arabia can be: (1) nursing technicians, who have a high diploma in nursing, (2) nursing specialists, who have bachelor's degrees in nursing, or (3) nurses' aides, who have attended a one year course in nursing. ENs participating in the study were primarily either nursing technicians or specialists (90% or 76/84 of those who provided a response about their current clinical position). Participation in this study was voluntary and 106 ENs returned completed questionnaires (30% response rate).

Outline of responsibilities of the EN role

Registered ENs work in critical care emergency facilities as members of a clinical team with physicians, other nurses and allied health professionals to provide care, monitor health conditions, plan long-term care needs, administer medicine, use medical equipment, perform minor medical operations, and advise patients and their families on illness, care and follow on care after a hospital stay. The emergency preparedness plans during the Hajj for the four hospitals in Mecca state that the role of all types of ENs' includes the following five key clinical tasks: a) provision of general assessment and care for patients, b) triage of incoming patients, c) performing resuscitation if needed, d) demonstrating clinical leadership, and e) providing psychological care to patients. These key clinical tasks have been assessed in our questionnaire.

Study instrument

The instrument we 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 and spontaneous responses respectively and to allow respondents to

provide more in-depth information, where appropriate [22]. The questionnaire was designed and hosted on the 'Survey Monkey' website.

The development of the questionnaire's content was informed by similar studies [1, 2, 11]. The questionnaire used in the current study borrowed extensively from the questions posed by the researchers in the studies enumerated above. The content was further adapted to include key clinical tasks described in the hospital emergency preparedness plans as advised by local experts during the pilot study. Consequently, the tool analyzed the self-reported knowledge, skills, and perceptions of ENs in Mecca with regards to disaster preparedness, including EN's awareness of the standards for their roles as outlined in the Major Incident Plans of the four hospitals in Mecca.

In this study, the questionnaire included 18 questions, which were divided into five sections: (1) Knowledge and Awareness in relation to disaster preparedness. This section of the questionnaire addressed this aspect of the study by contextualizing disaster response in the hospital setting in Mecca. The responses of the participants were measured in a 5-Point Likert Scale (1 for Strongly Agree and 5 for Strongly Disagree). (2) Roles of nurses in disasters. This section comprised 12 items, which were measured in a 5-Point Likert Scale and focused on the role of nurses in providing care, psychological assistance, and triage, also as delineated in local hospital emergency and disaster preparedness plans (i.e. the Major Incident Plans). (3) Education and training; four items were designed to identify types of disaster education and training available and perceived as relevant by the ENs in hospitals in Mecca. (4) Previous experience on disaster response; nine items explored respondents' involvement in disaster management in the past. (5) The fifth section of the questionnaire explored the demographics of the participants.

Ethics approval

The School of Health Sciences Research Ethics Committee, City, University of London and the Ministry of Health in Saudi Arabia and the R&D departments of the participating hospitals approved the study. All participants provided informed consent.

Data collection

The questionnaire was initially piloted with ENs in the hospital the first author is employed. The pilot group was then broadened to also include local experts and staff from other hospitals. Specifically the pilot group comprised faculty members from King Abdulaziz

University, School of Nursing (one male and one female), two members of the management staff (one male and one female) in two of the selected public hospitals, and five nurses (three females and two males) from the ED of the public hospitals selected for the study. It is important to note that the two faculty members were not drawn from the study population. On the contrary, they were experts in the field of nursing research. The aim of using them was to determine the suitability and adequacy of the questionnaire to the current study given their experience in this field. On their part, the management staff and ENs were involved to ensure that the participants could understand the questions posed in the survey and that the survey was realistic, feasible and workable to execute within a reasonable timeframe. The experts suggested some adjustments in the language of the questionnaire items to make them specific to the field of emergency nursing in Saudi Arabia. The management team and ENs suggested merging some questions to reduce the time needed to complete the survey. The revised questionnaire following the pre-test took an average of 10 to 15 minutes to complete.

The questionnaire was made available in the English language. Forward and backward translations to the Arabic language were conducted by two bi-lingual ENs during the piloting stage. The importance of having an English language translation was due to the fact that the majority, 53.1% in 2009, of nurses working in public hospitals in Saudi Arabia are non-Saudi nationals [23]. Also all nurses in the Emergency Departments in the hospitals studied were fluent English speakers. 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 in September 2014. Participation by respondents was voluntary. To address potential sources of bias we followed five steps. First, we implemented an appropriate survey structure, which drew on published peer-reviewed questionnaires from similar studies as detailed earlier in this paper. Second, we carefully considered the categorization (i.e. grouping questions thematically into five sections) and ordering of questions with the aim to decrease dropout rates and ensure that the respondents are more truthful with their answers. Third, our data analysis plan informed the crafting of the survey so that the questions were linked to our study objectives. Fourth, the questionnaire was sent out to the whole population of ENs in all public hospitals in Mecca. Fifth, we conducted a pilot using a sample of people from the survey population and additional feedback from local experts to ensure coverage of key topics and that all respondents interpret the question the same way.

Data analysis

The survey data collected was analyzed quantitatively using the statistics analysis software 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. Missing values are indicated in parentheses in the results tables when responses to specific items where less than N=106. Missing values related primarily to participant demographics data. The use of an online survey prevented participants from skipping answering questions and as a result minimized any missing data to questionnaire items. Descriptive statistics were generated including mean, median, mode, standard deviation, frequencies counts and percentages, and crosstabs with the Chi-square statistic. Charts and figures were produced to facilitate understanding and comparisons, where appropriate. Statistical significance was defined as $p<.05$ for all statistical tests.

RESULTS

Respondents' Demographic Characteristics

Table 1 summarizes the demographic characteristics of the respondents. The majority were aged between 20 and 40 years. There were more male (52.8%) than female nurses (24.5%), although 22.6% of the respondents declined to specify gender. Over half of the respondents were employed as either nursing technicians or nursing specialists (42.5% and 29.2%, respectively, or 53.6% and 36.9% respectively of those who answered this question); few were nursing aids (3.8%). About 52% of the respondents reported 0-5 years' experience in ED, followed by 6–10 years for 32.9%, and 11.0% with 11–15 years. Most respondents had worked in the field of emergency nursing for 0–5 years and 6–10 years (43.4% and 21.7%, respectively); 12.2% of the respondents had over 10 years' field experience, of which 2.8% of respondents had over 20 years' experience.

Table 1: Demographic characteristics of respondents (N=106).

Variable	Frequency	Percentage (%)
Age group (N=86)		
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 (N=84)		
Nursing technician	45	42.5
Nursing specialist	31	29.2
Nursing aid	4	3.8
Other current clinical position	4	3.8
Years of work in current emergency department (N=82)		
0–5	43	52.4
6–10	27	32.9
11–15	9	11.0
16–20	1	1.2
More than 20	2	2.4
Years of work in the field of emergency nursing (N=82)		
0–5	46	43.4
6–10	23	21.7
11–15	8	7.5
16–20	2	1.9
More than 20	3	2.8

Emergency Nurses' Disaster Knowledge and Awareness

The reported knowledge of disaster preparedness by ENs was surprisingly very low. Table 2 shows the responses to the 'knowledge assessment test' on topics where there are often misconceptions on the appropriate management of a disaster. Only one in three of the respondents (34.3%) correctly responded that most casualties from a disaster arrive to EDs via the Saudi Red Crescent. Saudi Red Crescent (SRC) is "a humanitarian society that provides emergency medical services in all regions of the Kingdom of Saudi Arabia. It was founded in 1963" [24]. A key function of the SRC is to transport patients to EDs and also provide emergency medical services and emergency food supplies in disasters. It also contributes to raising the level of health awareness in the country. Similarly, only 32% of ENs correctly responded that disease epidemics are an almost inevitable result of the disruption and poor health caused by major disasters; only 29.1% were mindful that the poor are more at risk of death than rich people or the middle classes during a disaster; only one in five (20.6%) correctly responded that un-buried dead bodies would not create a disease

epidemic following an MG disaster; and only one in six (16.3%) responded correctly that all victims of a chemical biological radiological (CBR) incident will have dangerous substances removed at the scene of an incident prior to their arrival to hospital. These findings demonstrate a significant deficit in Emergency Nurse's reported knowledge and awareness to effectively respond to disaster within all Mecca's public hospitals.

Table 2: Respondents 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	34.3%
Disease epidemics are an almost inevitable result of the disruption and poor health caused by major disasters	33	32.0%
The poor are more at risk of death than rich people or the middle classes during a disaster	30	29.1%
Un-buried dead bodies will not create a disease epidemic following a mass gathering disaster	21	20.6%
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	16.3%

The Role of Emergency Nurses during MGs

Table 3 presents the ENs' perceptions of their role during the Hajj mass gathering. Respondents perceived their dominant role as providing general assessment and caring for patients (38%), followed by triage (26%) and resuscitation (21%); whereas the respondents gave lower priority to their leadership role (14%); and only one respondent viewed her role as including providing psychological care (1%).

Table 3: ENs' perceptions of their likely role in an MG disaster response during the Hajj pilgrimage (N=86).

What is your likely role in a mass gathering disaster response during the Hajj?	Frequency	Percentage
General assessment and caring for patients	33	38.4%
Triage	22	25.6%

Resuscitation	18	20.9%
Leadership	12	14.0%
Psychological care	1	1.2%

Table 4: Level of understanding of EN role in MG disasters among study participants (N=106) (%).

Role variables	Strongly disagree	Disagree	Neither	Agree	Strongly agree	Total Agree
Emergency nurses are confident and knowledgeable in effectively responding to a mass gathering disaster	0.0	1.9	12.4	38.1	47.6	**85.7**
Emergency nurses are key players in a mass gathering disaster	0.0	5.7	11.4	38.1	44.8	**82.9**
The main role of emergency nurses during disasters is to provide general assessment and caring for patients	2.8	1.9	13.2	41.5	40.6	**82.1**
Emergency nurses are able to provide timely response to emergency situations	1.0	5.8	13.5	35.6	44.2	**79.8**
The main role of emergency nurses during disasters is to provide resuscitation	1.0	6.7	17.3	28.8	46.2	**75.0**
The main role of emergency nurses during disasters is to provide triage and initial consultation	2.9	7.6	16.2	39.0	34.3	**73.3**
During mass gathering disasters emergency nurses are responsible for clinical response	1.0	4.8	21.0	45.7	27.6	**73.3**
Emergency nurses can effectively communicate with patients, families and other clinicians to provide therapies	2.8	5.7	19.8	34.9	36.8	**71.7**

during emergency situations						
During mass gathering disasters emergency nurses are responsible for surveillance	1.9	13.6	18.4	42.7	23.3	**66.0**
During mass gathering disasters emergency nurses are responsible for prevention	2.9	13.3	20.0	40.0	23.8	**63.8**
The main role of emergency nurses during disasters is to act as team leaders	1.9	16.0	22.6	34.0	25.5	**59.4**
The main role of emergency nurses during disasters is to provide psychological care	5.7	16.2	27.6	30.5	20.0	**50.5**

As summarized in Table 4, most ENs in Mecca's public hospitals appeared to be confident and knowledgeable about their roles to respond effectively to mass gathering disasters. They reported seeing their main role as providing general assessment and care, with a timely response, including resuscitation, triage and initial consultation, and most reported to communicate well with others during emergency situations; however, fewer ENs see their role as providing surveillance, prevention, leadership, or psychological care in a mass gathering disaster, despite all these roles being described in the standards of care of the hospitals' emergency plans in disaster response.

Disaster Education and Training

All respondents indicated they had received some form of disaster education and training. However, the recency of this training varied substantially, which is an important factor to bear in mind given that the Hajj is an annual event in Mecca; only 34% had attended training in the last 6-12 months, 23% attended it in the last 12-24 months, and 43% attended such training over 2 years ago.

EN respondents indicated that the top three most beneficial types of education and training courses for disaster response preparedness were: (1) Hospital education sessions, which were suggested by 43% of respondents. Hospital education sessions involve free courses provided by the Training and Education Centers in Saudi hospitals. (2) The Emergency Management

Saudi Course and Workshop, which was suggested by 27% of respondents. The Saudi Emergency Management course is delivered in Mecca and provides special training for ENs over 2-3 days to help them improve their knowledge of handling emergencies in preparation for the Hajj. (3) Short courses in disaster management, which were suggested by one in ten participants (11% of respondents). These are courses provided by private organizations.

In contrast, university training in disaster management was perceived as important by only a minority of respondents (8%), as was online education about disaster management (6%) and self-learning (3%).

Level of Awareness of the Hospital Department's Major Incident Plan

A Major Incident Plan is a contingency plan prepared by the hospitals' departments, which details the critical procedures to be followed in the case of unexpected incidents. Almost half of the Emergency Nurses (47.1%) reported to have read their department's Major Incident Plan thoroughly. However, just less than one-quarter of the nurses (23%) reported that they had only flipped through it, and over one-fifth of them (21.8%) had not read it. Moreover, 8% of them didn't know they had one. To be fully prepared for a mass gathering disaster, all ENs are expected to thoroughly read their department's Major Incident Plan. Nonetheless, over half (52.8%) of the ENs in Mecca's public hospitals had not thoroughly read the plan, and some of them were not even aware of its existence. This suggests 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 Emergency Department. This could considerably impact on staffs' stress levels following a major incident and put patients' safety at risk.

Previous Disaster Response Experience

Almost all (99%) of the respondents had previous experience of some type of disaster response. Figure 1 illustrates the frequency and range of previous disaster experiences among study participants; almost one in two (47%) had experiences of a fire disaster, one in four (24%) of a transport disaster, just over one in five (21.7%) of a building collapse, one in six (16%) of a flood, almost one in eight (12.3%) of a stampede, or an epidemic outbreak, and one in ten (9%) of a biological and chemical disaster.

Figure 1: Previous disaster response experience of EN respondents (N=86) (%).

A Chi-square analysis examined the relationships between clinical positions, years in clinical practice and previous disaster response experience and found that specialist nurses are more likely to have previous disaster response experience, than other nursing grades; specifically, 71% of nurse specialists had previous disaster response experience, as compared with nurse aides (25%) and nurse technicians (48.9%). This difference was statistically significant, $X^2(3) = 8.373$, p=0.039.

DISCUSSION

Level of Awareness and Knowledge to respond to MG disaster reported by ENs in Public Hospitals in Mecca

Disaster knowledge and awareness is a critical component in relation to the preparedness of Saudi nurses for MGs and is a declared priority for the Saudi Arabian Ministry of Health [10, 13]. According to Tawfiq and Memish [10], during the Hajj, twenty four committees are tasked with the responsibility of promoting awareness and effective communication in preparation for a mass gathering disaster. For example, the Supreme Hajj Committee, and the Hajj Preventive Medicine Committee undertake preventive measures prior to, during, and after the Hajj [25]. Information regarding estimated imminent disasters or with high likelihood of occurring is collected and shared by the Saudi Arabian Ministry of Health and the World Health Organization. Despite significant national investment in preparing an extensive communication and knowledge dissemination infrastructure in this field, ENs who participated in this study reported low levels of knowledge on effective disaster response to the Hajj pilgrimage mass gathering. This finding signals the need for substantial improvement in this area, including effective reach-out communication strategies and training targeting nurse practitioners, which currently appear to be substandard.

Disaster Education and Training

Education and training on disaster preparedness varied significantly by the clinical post the nurses in our sample held. Involvement in disaster exercises needs to become more standardized and inclusive for all nursing grades in the Emergency Department, in particular targeting the less senior roles of nurse technicians and nurse aides.

The Saudi Arabian Ministry of Health has undertaken extensive education and training programs for ENs and this was somehow reflected in our participants' responses, since almost nine out of ten nurses in our sample reported participation in related education and training events.

One of the key developments with regards to education and training for Saudi ENs is the emergence of the specialist field of 'Hajj Medicine'. According to Shafi *et al*. [13], this nascent field of applied clinical practice entails management and control of emerging and common health problems during the Hajj. What makes the Hajj so unique for education and training in MGs is that it is the oldest studied MG in the modern world, with reports on the medical management of disease outbreaks published since the 1800s [26]. Saudi ENs can extent their 'hands-on' practice experience by reflecting more systematically on this body of codified knowledge and the lessons learned from many years of effective public health surveillance in the challenging setting of one of the world's largest MGs.

Previous Disaster Response Experiences for Emergency Nurses

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 the Saudi public health authorities' exemplary management of communicable diseases in MGs. The WHO [4] based their praise on the high level of experience among health workers and their previous undertakings during the Hajj pilgrimage [10, 27].

It is noted that some Saudi ENs lack previous first-hand experience in disaster management. However, it is apparent that the level of exposure of ENs to challenging conditions associated with MGs is considerably higher in Saudi Arabia than in most countries. According to Hammad *et al.* [1], South Australian Emergency Nurses have limited immediate experience in responding to emergencies from prior participation in MG disasters. According to Shafi et al. [13], Saudi public health officials and health workers, together with policy makers, have seasoned experience and expertise in relation to disaster preparedness and management. The experience stems from the seasonal Hajj occurrence and from other gatherings taking place regularly in the locality.

The majority of study participants reported that they can effectively communicate with patients, families and other clinicians during emergency situations. Yet, almost one in three ENs reported that they feel they require training to improve these communication skills through, for example, role-play, tabletop drills, or mentoring.

In terms of training and educational initiatives proposed by the respondents, the majority of ENs in this study find hospital education sessions most beneficial, followed by the Emergency Management Saudi courses in disaster management. Therefore, these course training formats should be further developed and expanded to ensure that all Emergency Nurses attend frequently (at least once per year). Secondly, approximately one-fifth of the Emergency Nurses are willing to self-learn and use online education about disaster management, which they find beneficial. The online format is very promising, as it can be deployed to all nursing students with access to the Internet (via smart phones, tablets, and personal computers). The policy makers and nursing educationists should tap into these avenues for increasing competency among nurses.

Overall, the findings from this study on the roles of the Saudi ENs in Mecca, suggest that these nurses are expected to perform a wide range of clinical activities outlined in the Major Incident Plans of local hospitals. Such clinical activities include prevention, surveillance, general assessment and caring of patient, triage, resuscitation, leadership and psychological care. However, judging from the nurses' responses to our questionnaire, ENs appear to put less emphasis on the domains of leadership and psychological care, revealing a rather narrow clinical focus on physical health. They also seem to be geared towards the clinical tasks of acute care provision rather than the more proactive clinical activities of surveillance and prevention.

CONCLUSION

This study sheds some light to provide a better understanding of the role, though not capacity, that ENs in Mecca are expected to play in disaster preparedness during the Hajj MG. The findings from this study suggest that despite the substantial experience gained through clinical engagement in prior MGs, there is a worrying deficit in knowledge of the Major Incident Plans for ENs working in public hospitals in Mecca. The findings also suggest that ENs seem to be reluctant to undertake a leading role during a disaster response, and to provide preventive and psychological care. Nonetheless, these are essential skills for every individual nurse, who may be called on to make decisions or to support psychologically patients who are affected by stress, panic and/or trauma during the disaster.

The ENs are expected to engage in a wide range of activities geared at assisting members of the public. Hospital, online, and university-based training courses, and workshops, must include a specific focus on disaster response for Hajj and also cover content in the above seemingly neglected areas of clinical practice. The responsibility for this undertaking needs to be overseen by both the local and national-level policy-makers, with potential involvement of the WHO.

Involvement of ENs in disaster exercises needs to be encouraged and further supported by hospital management and the Ministry of Health, as one in five study participants reported that they have never been involved in disaster exercises, and four out of ten reported to have been involved only once.

Limitations and Suggestions for Future Research

A limitation of this study is the cross-sectional design, which provides a ‘snapshot’ of ENs' responses, at one moment in time. Second, this study included the responses by ENs, but it is also important to survey and interview other clinicians, such as doctors and paramedics, who play an equally crucial role in reducing fatalities at Hajj, and other MG disasters. Finally, the relatively small sample size (N=106), non-random sample, and single setting (Mecca’s all four public hospitals), the relatively heterogeneous (three different nursing grades) and rather non-typical group of nurses participating in our study (half of the nurses in our sample being trained abroad) mean the results can only be generalized to other regions of Saudi Arabia and beyond with great caution. A larger national survey of all ENs who have a role in MGs is needed, to gain a broad understanding of their knowledge, experience and training needs for

disaster 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 nurse training to enhance patient safety. This study did not explore differences in hospital training and exercises across the four hospitals. This is a possibility, and warrants future research, which might explain the reported variation in frequency of disaster education, training, and exercise involvement among study participants.

Contributorship statement

Fuad Alzahrani conceived the study and acquired the data. He drafted the work and approves the final version submitted for publication. He agrees to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Dr Yiannis Kyratsis offered substantial contribution to the design, analysis and interpretation of data for the work. He revised the work critically for important intellectual content. He approves the final version submitted for publication and agrees to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Competing interests

Fuad Alzahrani works as an Emergency Nurse at the King Fisal Hospital in Mecca Saudi Arabia. He received a graduate Scholarship Grant by the Saudi Arabian Ministry of Health.
Dr Yiannis Kyratsis has no competing interests to declare.

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Data sharing statement

Additional unpublished data from the study are available in the MSc Dissertation document titled: “Nurse Emergency and Disaster Preparedness during Mass Gatherings: a cross-sectional survey in public hospitals in Mecca, Saudi Arabia” City University London 2015.

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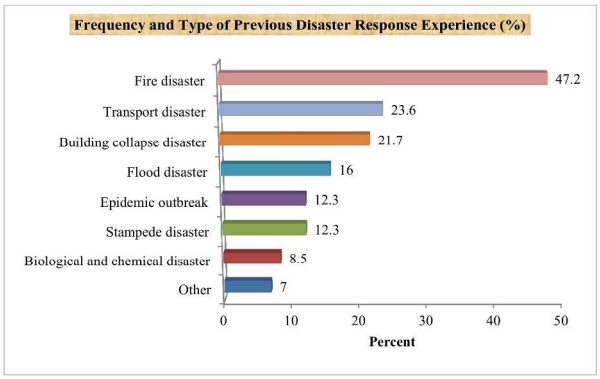

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STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4, 5
Objectives	3	State specific objectives, including any pre-specified hypotheses	6
Methods			
Study design	4	Present key elements of study design early in the paper	6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	7, 9
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	7, 9
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	8
Bias	9	Describe any efforts to address potential sources of bias	9
Study size	10	Explain how the study size was arrived at	7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	N/a
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	10
		(*b*) Describe any methods used to examine subgroups and interactions	10
		(*c*) Explain how missing data were addressed	10
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	n/a
		(*e*) Describe any sensitivity analyses	n/a
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—e.g. numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	10, 11
		(b) Give reasons for non-participation at each stage	n/a
		(c) Consider use of a flow diagram	n/a
Descriptive data	14*	(a) Give characteristics of study participants (e.g. demographic, clinical, social) and information on exposures and potential confounders	10, 11
		(b) Indicate number of participants with missing data for each variable of interest	Table 1 in brackets on p.10, & p.11 Table 3 in brackets on p.12 & p.13
Outcome data	15*	Report numbers of outcome events or summary measures	n/a
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	n/a
		(*b*) Report category boundaries when continuous variables were categorized	n/a
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	16
Discussion			
Key results	18	Summarise key results with reference to study objectives	16-18
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	19, 20
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	19
Generalisability	21	Discuss the generalisability (external validity) of the study results	19, 20
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	20

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.