Emergency department registered nurses' disaster medicine competencies. An exploratory study utilizing a modified Delphi technique

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1. Introduction

Recent attacks in Europe are reminders that terrorism increasingly targets private citizens in large public gatherings and is a growing global concern to public health and disaster preparedness [1]. While current trends (2014–2017) indicate fewer reported terrorist attacks, the world has seen an increase of terrorist activity since September 11, 2001 [1]. Terrorism or other antagonistic incidents however, are only one type of event that may cause large numbers of casualties. Indeed, a broad spectrum of incidents (technological, natural and social) cause disasters. Globally, the number of reported disasters has increased [2]. With approximately 220 million people affected worldwide and 85 million people affected by disasters in Europe and North America in 2016 alone, the cost of human suffering in terms of death, illness and injury is incalculable [3,4].

1.1. Disasters

Disasters, according to the United Nations are events that "exceed the ability of the affected community to cope using its own resources" meaning medical needs exceed health care's ability and resources to maintain adequate care for everyone. The goal of health care during disasters shifts to maintaining adequate care for the greatest number of patients [5,6]. A major incident (MI) is similar to that of a disaster, with the main difference being that quality care for everyone is maintained through adequate redistribution and allocation of resources [7–11]. Emergency departments are vital components in mitigating the effects of disasters or major incidents. Disasters/MIs often result in mass causalities at the incident site, with many victims requiring pre-hospital assessment and care. However, a large number of patients, often described as self-presenters, arrive at the emergency department (ED) without pre-hospital assessment [12]. When a MI occurs, ED departments may be required to quickly increase their operational capacity to receive, prioritize and treat the rapid flow of patients. This ability to increase the capacity of the ED to manage the sudden influx of patients is a hospital's surge capacity [13,14]. With escalating waiting times and crowding at EDs [15] affecting surge capacity negatively, front line health care workers' skills, knowledge and abilities are essential.

1.2. Registered nurses' competencies

The chain of health care ensures that personnel at ED may be among the first line of health care workers to receive, assess and treat victims of a mass casualty incidents. Self-presenters add an extra dimension for ED registered nurses, further stressing the importance for their disaster response competencies [16]. According to disaster medicine regulations, hospital disaster preparedness plans should ensure that all personnel involved in disaster preparedness are provided the necessary education, and training. In addition regulations stipulate the need for evaluation of staff preparedness [17,18].

Nurses represent the largest group of registered health care professionals in Sweden [19]. Emergency Department registered nurses' competencies are vital for mitigating effects of MI's [20,21]. The International Council of Nurses (ICN) recognizes the importance of RN's role in disaster situations and stresses the importance of nurses' knowledge of a broad range of disaster medicine competency domains (epidemiology, physiology, pharmacology psychological issues, and cultural-familiar structures) [22]. Although recognized as important, a review of literature revealed that specific disaster medicine competencies for ED registered nurses, as well as a method for assessing disaster preparedness of emergency department registered nurses may be vague or missing [23,24].

The ability to assess disaster preparedness, as well as training and educating staff as required may be difficult [25,26]. Training and education in disaster response should be planned in relation to defined learning objectives based on what the nurses need to master. Without first reaching consensus on essential competencies, an accurate description of the level of disaster preparedness among registered nurses'

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in EDs remains elusive and incomplete in those settings. Currently there is no national disaster medicine-specific competency description for ED RNs in the study setting. Hence, there is no accepted tool for assessing emergency department nurses' disaster preparedness in the study setting. To evaluate ED registered nurses' disaster preparedness, essential disaster medicine competencies must first be identified.

2. Aim

The aim of this exploratory study was to identify essential disaster medicine competencies for emergency department registered nurses through expert consensus.

3. Method

3.1. Study design

A modified Delphi technique was utilized to achieve consensus concerning essential disaster preparedness competencies for emergency department registered nurses [27]. The Delphi technique assumes that expert group opinion is more valid than that of an individual and is used to gather opinion on the subject under investigation. The Delphi technique is a repetitive process consisting of rounds in which items are sent to an expert group for assessment until consensus is reached [28]. This Delphi study commenced with items from a previously developed study containing disaster nursing competencies utilizing a three-round modified Delphi technique [20]. Three rounds are generally accepted as adequate for a modified Delphi analysis due to the risk of study fatigue. The study was concluded after the final round as pre-determined and agreed upon by the authors and experts [28].

3.1.1. Panel of experts

The term 'expert' was defined as a specialist within their specific field, in this case emergency and/or disaster medicine [29]. Heterogeneity within a specific field when selecting a panel of experts is generally regarded as a positive attempt at securing a broad spectrum of opinion [30]. To achieve heterogeneity within the specific field, experts with various backgrounds including academic and clinical expertise within disaster or emergency medicine were invited. For analysis purposes, these subgroups were then treated as a homogenous group. While the majority of experts were from Sweden, experts from seven countries (Sweden, Norway, Canada, Iran, Finland, Israel, Italy and South Africa) were included in the panel (Table 1).

Selection of experts: A purposeful sample and snowball technique was used and generated a panel of 40 experts. Authors' personal knowledge were utilized in identifying academic experts as well as disaster preparedness coordinators. The local disaster preparedness coordinators recruited two RNs from each of the six emergency departments.

Table 1
Demographics data of the panel of experts.

Gender	
Male/Female	12/28
Expert Categories	
Academic National	9
Academic International	8
Disaster preparedness coordinators	11 (2 regional/9 local)
RNs	12
Total	40
Years of experience within expert field	
1–5	3
6–10	8
11–20	17
> 20	9

The international and national academic experts had advanced degrees (i.e. masters or higher) in disaster or emergency medicine. In addition to an advanced degree in disaster/emergency medicine, nine academic experts had pre-hospital research and or pre-hospital clinical experience. Disaster preparedness coordinator experts held current employment as disaster preparedness coordinators. Registered nurses included in the panel of experts had a minimum of two years clinical experience and current employment in the emergency department setting.

3.1.2. Basis for the study material

A classic Delphi study uses the first round as an open round to generate items or questions [28]. This study utilized a modified Delphi technique in which the first round instead consisted of pre-determined statements to initiate discussion on the subject matter [27]. A previously developed questionnaire, Emergency Preparedness Questionnaire (EPIQ) was modified with item refinement prior to round 1 and was provided to all experts in round 1. The contents of the EPIQ consist of 45 items concerning RNs' self-perceived disaster preparedness and are divided into 12 predefined competence domains [31]. The content of the document sent to the experts in round 1 was based on the (EPIQ). The original EPIQ, having since been modified and tested for reliability and validity [32,33] was constructed by a group of experts lead by the Wisconsin Nurses Association that identified first responder competencies needed in large-scale events [31].

Prior to round 1 of this study, the EPIQ was modified in order to make certain items and contents of domains slightly more concise. This led to the expansion of specific items. For example, "The appropriate care of sensitive/vulnerable patient groups during a large-scale emergency (i.e., aged, pregnant women, and the disabled)" was divided into three specific and separate questions. In addition, two items under "detection of an event" were expanded with specific biological agents. The number of items based on EPIQ were thereby expanded from 45 to 59 prior to round 1.

3.1.3. Delphi rounds

A total of 40 formal invitations consisting of details concerning the study method, confidentiality, expected length of the study and instructions, along with the questionnaire were sent to the experts. The experts were asked to rate how essential each item is for RNs' disaster preparedness using a 5-point Likert scale. 5 = Very essential, 4 = Quite essential, 3 = Neither essential nor unessential, 2 Quite unessential, 1 = Not at all essential. Experts were encouraged to give comments and suggestions for new statements to be considered and added to the questionnaire in subsequent rounds. Feedback after rounds 1 and 2 was sent to each expert with their rating in relation to each statement as well as the expert group's mean value for each statement, giving them an opportunity to reevaluate their ratings. Statements that reached consensus were included in the feedback and subsequently removed prior to the following round. The newly revised questionnaire consisting of statements that had yet to attain consensus as well as new statements was then sent to the experts in rounds 2 and 3 for evaluation and rating.

3.1.4. Data analysis

The consensus level for this study was predefined at 75% [34]. Results for each individual statement for every round were trichotomized in ratings of 4–5, 3, and 2 and below [35,36]. Ratings of 4–5 were deemed "essential" and ratings of 2 and lower non-essential. Items that reached consensus were removed prior to subsequent rounds while items that failed to reach the 75% consensus rate were included in subsequent rounds for further evaluation. Data from all rounds was analyzed using SPSS version 23 (IBM SPSS Statistics North Castle, New York, USA) for measuring mean, and standard deviation. Means and standard deviation were used for analysis and feedback to the experts, indicating level of importance according to the panel [28,37].

Table 2
Expert group response rate per round.

	Researchers National	Researchers International	Disaster preparedness coordinators	RNs	Total
Invited	9	8	11	12	40
Round I	9	6	11	10	36/40 (90%)
Round II	9	6	11	8	34/37 (92%)
Round III	9	6	10	7	32/35 (91%)
Overall response rate					32/40 (80%)

3.1.5. Ethics approval and consent to participate

Participants were informed the aim of the study and assured anonymity and confidentiality concerning the information rendered from this study. Principles as stated in the World Medical Association Declaration of Helsinki and Swedish regulations regarding ethics were adhered to Refs. [38,39].

4. Results

Of the 40 experts that agreed to participate, a total of 32 completed the study, with an overall response rate of 80% (Table 2).

The major finding of the study was consensus of 62 specific competencies. The remaining 7 items that reached consensus concerned knowledge of organizational activities and administrative routines (items 10, 11, 18, 19, 20, 29, 68). There was consensus concerning the importance of daily emergency care nursing competencies such as basic first aid, and triage, as well as more specific and advanced competencies. The specific and advanced competencies encompassed special populations and rare events such as biological/chemical events and proper actions regarding these incidents. In addition, competencies concerning the incident command system including disaster preparedness plans and decision making were seen as essential disaster medicine competencies for ED registered nurses (Table 3).

4.1. Round 1

Response rate after two reminders was 90% (N = 36). One international expert and two RNs failed to turn in completed questionnaires. Of the 59 statements sent to the expert group in round one, 89% (n = 53) reached the predetermined consensus level of 75% with a means ranging from 4.11 to 4.86 (SD 0.35–1.73). The six statements that failed to reach consensus concerned the areas of Incident Command System (ICS), decontamination, psychological issues and critical resources. Comments from experts resulted in 17 new statements resulting in a total of 23 items sent to the experts in round 2 (Table 4).

4.2. Round 2

Non-response of two experts during this round resulted in a response rate of 92% (34/37). Of the 23 statements included in round 2, a total of 16 reached consensus (75%) with a mean between 4.13 and 4.80 (SD 0.40–0.90).

4.3. Round 3

Response rate for round three was 91% (32/35) with an additional member of the RN group as well as a disaster preparedness coordinator not responding despite two reminders. In this final round, the seven items that had failed to reach consensus in previous rounds were distributed to the experts. Only one of the seven items, "Reporting according to the principles of SBAR" (Situation, Background, Assessment, Recommendation) [40] reached consensus with a mean of 4.28 (SD 0.85). No new items were included for round 3 (Fig. 1).

5. Discussion

The Delphi technique ensures that opinions of individual experts carry the same weight throughout the consensus process. In addition, the nature of the Delphi in which no face-to-face meetings are held, ensure both anonymity of individual answers and limit influence of individuals on each other. Furthermore, the Delphi technique facilitates effective time management which possibly aids in a high rate of continued participation throughout the process. The expert panel in this study was comprised of experts with various focal points within the field of disaster/emergency medicine. The selection of experts with varying backgrounds within the same field minimizes bias as well as ensures that vital viewpoints encompassing several aspects of disaster preparedness are represented [34]. The majority of the experts had several years of experience within the field of disaster medicine and many were clinically active, using disaster related competencies on a daily basis. This ensures that the panel of experts' opinion adequately represents the competencies required for adequate disaster response of ED registered nurses in the study's examined region.

A total of 62 specific competencies for emergency department registered nurses' disaster preparedness reached consensus. Theses specific competencies appear to mirror the complex nature of the broad spectrum of events that may cause a major incident or disaster.

Disaster medicine nursing is a complex field encompassing an extensive spectrum of specific competencies needed for mitigating the short and long term somatic and psychological effects of the event. Emergency department RNs are in essence front line health care professionals, being in many cases the first to receive, assess, and treat patients in the hospital. Major incidents may test the ED's ability to maintain quality care for all patients in need. A hospital's surge capacity may be overwhelmed by the sudden wave of patients arriving at the ED with a large portion of these patients likely being self-presenters. ED nurses' basic nursing competencies in daily roles are fundamental for disaster medicine preparedness and management.

Routines for assessing and treating patients may need to be adjusted to accommodate the considerable and sudden influx of patients. Indeed, there seemed to be a general consensus regarding the importance of basic nursing competencies such as "basic first aid" (mean 4.86 SD0.48), "rapid assessment of a patient" (mean 4.81 SD 0.58) and "principles for treatment according to standardized principles" (mean 4.86 SD 0.43). This stands in slight contrast to a concern expressed by some experts between rounds that certain competencies were not necessarily disaster medicine specific competencies, such as "Symptoms for varying injury mechanisms including chemical, explosive and shootings" and the aforementioned "Principles of treatment and care". These findings seem to mirror the ICN's assessment that a key factor in successful treatment of patients from a MI is basic nursing knowledge (ATLS, TNCC, PHTLS) [41]."

Disaster plans often stipulate how staff and ED are notified of major events. However, official notifications may be delayed, or the event may compromise systems of communication, making patients or non-official personnel may potential providers of initial information for the receiving staff of the event. This stresses the importance of nurse's knowledge of disaster plans as well as competencies concerning signs and symptoms of various conditions at an early phase. The results of

Table 3
Items that reached consensus (75%) divided into 12 competency domains.

Area	Mean	SD	Round in which reached consensus was reached
1 Detection of and response to an event			No
1 Basic first aid in a large-scale emergency event (including oxygen administration and ventilation)	4.86	0.48	1
2 How to evaluate the effectiveness of your own actions during a large-scale emergency event	4.47	0.86	1
3 History and physical assessment surveillance data for creating a high index of suspicion that a patient has been exposed to a category A,B, or C biological agent	4.65	0.48	1
4 The procedure used to document provision of care in a large-scale event	4.62	0.64	1
5 Chain of custody during a large-scale emergency event. (what you are legally responsible for documenting)	4.57	0.80	1
6 Nurses' Immediate actions when the public emergency notification signal is sounded when not on duty	4.33	0.78	2
7 Recognize symptoms for varying injury mechanisms including chemical, explosive and shootings	4.29	0.66	2
8 The Mobile medical team's (medical team sent from the ED to the scene of the incident) role and mission including routines for documentation	4.31	0.9	2
9 Routines for internal threats such as operational disruptions (water supply, power outage) threats of attack toward the hospital as well as the outbreak of fire	4.77	0.49	2
10 How nurses not on duty receive information concerning their hospital's current preparedness level	4.32	0.97	2
11 How registration of patients is conducted during a major incident	4.83	0.45	2
12 Regarding the application of privacy act (2009:400) during a major incident	4.53	0.73	2
2 The incident command system (ICS)			
13 The content of the emergency operations plan (EOP) in your agency/organization	4.81	0.76	1
14 To which functional group in the Incident command system (ICS) you would be assigned during a large-scale emergency event	4.78	0.72	1
15 The physical location where you would report to if a large-scale emergency event occurred	4.75	0.65	1
16 Assess and respond to site safety issues for self, co-workers, and victims during a large-scale emergency event	4.77	0.65	1
17 The strategic rationale used to develop the ICS response/action plan	4.14	1.07	1
18 Your agency's preparedness level for responding to a large-scale emergency event	4.54	0.87	1
19 Differences between decision making processes in the Incident Command System for a large-scale emergency event and non-emergency situations	4.27	0.99	1
20 Concerning their hospitals levels of preparedness and its significance	4.62	0.85	2
21 How a change in the medical level of ambition affects triage (alterations in standards of care)	4.80	0.40	2
22 Who is authorized to make the decision to change the medical level of ambition	4.77	0.54	2
3 Ethical Issues in triage			
23 How to perform a rapid physical assessment of a victim of a large-scale emergency event	4.81	0.58	1
24 How to perform a rapid mental health assessment of a victim of a large-scale emergency event	4.11	0.84	1
25 How to assist with triage in a large-scale emergency event	4.78	0.49	1
26 General issues related to the proper handling of the dead during a large-scale emergency event (ethical, legal, cultural and safety)	4.06	0.96	1
27 Treatment of patients exposed to high energy trauma as well as burn injuries	4.67	0.63	2
28 Principles of treatment and care according to A, B, C, D, E. (ATLS, TNCC, PHTLS)	4.86	0.43	2
29 Knowledge of how to create alternative space / rooms for triage.	4.37	0.84	2
30 Normal vital signs for different ages. (infants 0–11 months, children 1–12 years, adolescents 13–17 years)	4.13	0.93	2
4 Epidemics and Surveillance			
31 When to report an unusual set of symptoms to an epidemiologist	4.18	0.94	1
32 Diseases that are immediately reportable to state health departments	4.19	0.94	1
33 Ability to identify the exacerbation of an underlying disease due to exposure to a chemical or biological agent or to radiation	4.50	0.66	1
5 Biological			
34 Signs/symptoms of exposure to different biological agents	4.46	0.87	1
35 Signs/symptoms of botulism	4.14	0.97	1
36 Signs/symptoms of Middle East Respiratory Syndrome	4.34	0.91	1
37 Signs/Symptoms of H5N1	4.34	0.91	1
38 Signs/symptoms of foodborne illnesses i.e. Salmonella	4.03	0.99	1
39 Signs/symptoms of anthrax inhalation	4.32	1.04	1
40 Signs/symptoms of smallpox	4.17	1.07	1
41 Signs/symptoms of non-pulmonary anthrax	4.29	1,05	1
42 Signs/symptoms of Y. Pestis	4.09	1.04	1
43 Signs/symptoms of Ebola	4.53	0.89	1
44 Sign and symptoms of SARS	4.38	0.74	1
45 Modes of transmission for different types of biological agents	4.15	0.92	1
46 Understand/match treatments to specific biological/chemical agents	4.14	0.94	1
6 Isolation/Quarantine			
47 Isolation procedures for persons exposed to biological or chemical agents	4.86	0.35	1
48 Your facility's quarantine process	4.81	0.46	1
7 Decontamination			
49 Selection of the appropriate personal protective equipment (PPE) when caring for patients exposed to a biological, chemical, or radiological agent	4.86	0.42	1
50 The decontamination procedures stated in your facility's Emergency Operations Plan	4.73	0.56	1
8 Communication			
51 Procedures for communicating critical patient information to those transporting patients	4.78	0.42	1
52 Effectively present information about the degree of risk to various audiences	4.46	0.96	1
53 Identify the different abilities of key partners in your Emergency Operations Plan (EOP)	4.17	0.91	1
54 Appropriate debriefing activates following a large-scale emergency event	4.19	0.99	1

Table 3 (*continued*)

Area	Mean	SD	Round in which reached consensus was reached
55 Use of all types of communication devices (Phone, fax, email, satellite phones, PDAs. Etc.)	4.57	0.80	1
56 Reporting according to the principles of SBAR	4.28	0.85	3
9 Psychological Issues			
57 Appropriate psychological support for all parties involved in a large-scale emergency event	4.11	0.97	1
58 Signs of posttraumatic stress in patients seen for routine health care following and event	4.05	0.74	1
10 Special Populations			
59 The appropriate care of elderly patients during a large-scale emergency	4.41	0.79	1
60 The appropriate care of disabled patients during a large-scale event	4.39	0.87	1
61 The appropriate care of pregnant patients during a large-scale emergency	4.49	0.84	1
62 The appropriate care of infant patients during a large-scale emergency	4.47	0.91	1
63 The appropriate care of children ages 2–12 during a large-scale emergency	4.46	0.9	1
64 The appropriate care of young teens and teenagers (ages 13–18) during a large-scale emergency	4.41	0.93	1
65 The appropriate care and sensitivity to persons of different cultural backgrounds	4.24	1.01	1
66 Procedures for providing care to patients under 18 years of age during a large-scale emergency event in cases where prior consent from a parent/legal guardian is not possible	4.44	0.88	1
11 Accessing Critical Resources			
67 Knowledge of where to quickly access up-to-date resources about specific (Chemical, Biological, Radiological, Nuclear, and Explosive) agents during an event	4.73	0.61	1
68 Routines for accessing addition resources and space	4.31	0.79	2
12 Overall familiarity of disaster preparedness			
69 Please provide an assessment of your overall familiarity with response activities/preparedness in the case of a large-scale emergency event	4.44	0.76	1

this Delphi study indicate the importance of nursing competencies concerning detection of and response to an event (all items reached consensus) possibly further recognizing the ED nurse as first responders. Indeed, all items concerning "issues in triage" reached consensus as well perhaps further indicating ED nurses' roles in initial care as vital.

Also, worth noting is expert consensus concerning registering of patients during a MI. As previously mentioned, a surge of patients may require modified techniques for receiving, triaging and treating patients. The existing methods of patient intake may be inadequate. This harmonizes with findings by the Stockholm city council concerning actions taken by hospitals during the terrorist attack on April 7th l 2017 concluding that routines for registering patients during a MI need to be assessed [42].

While basic nursing competencies were identified as essential disaster competencies, nurses' ability to detect and treat victims of rare events were deemed vital as well. All items concerning epidemic, biological and isolation/quarantine as well as how to access specific critical resources concerning chemical, biological radiological and nuclear (CBRN) events reached consensus after the first round. Previous studies have reported low knowledge/preparedness for CBRN events [43,44]. However, expert opinion in this study indicates that these are essential competencies, highlighting the severity of these types of incidents and

the need for ED RN to be prepared.

Many hospitals have become highly specialized with the aim of providing optimal care for specific patient categories. Children and trauma patients are often diverted or directed to these specialized hospitals. However, following a disaster a number of patients, regardless of age, or preexisting underlying conditions tend to arrive at the hospital closest in proximity. Diverting patients such as trauma, pediatric patients and pregnant women may not be an option. These challenges and the inherent risks appear to be recognized by the expert group in as much as the entire set of competencies within the domain concerning special populations reached consensus further indicating the need for nurses to be skilled in a broad spectrum of medical fields.

A large majority of competencies reached consensus. Competencies that failed to reach consensus (means 3.45–3.72 SD 0.96–1.04), concerned actions that had long term implications such as psychological issues and impacts to the environment as well as items concerning competencies for cooperative efforts between agencies (mean 3.65–3.74 SD 1.01–1.11). These results may indicate that experts considered acute needs of afflicted patients as primary competencies or that these competencies may be more appropriate on a different level or that these competencies may be more appropriate on a different level.

The modified Delphi technique was an essential method for identifying desirable disaster medicine competencies. Through expert

Table 4

Items that did not reach consensus.

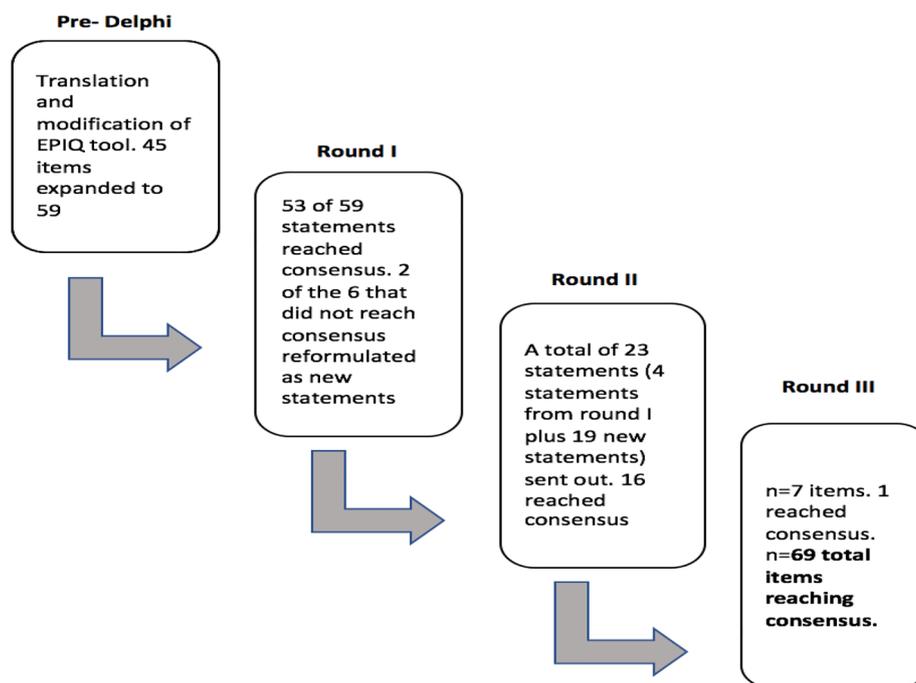| Area	Mean	SD
2 The incident command system (ICS) and their role in it		
Tasks that should NOT be delegated to volunteers in a large-scale emergency event	3.74	1.11
7 Decontamination		
The impact on the environment from a large-scale emergency event	3.69	0.99
8 Communication		
Agencies, other than health-care, within the Stockholm region that may be needed to co-operate with during a major incident	3.65	0.96
9 Psychological issues		
Providing health counseling/education to patient regarding the long-term impact of CBRNE agents (Chemical, Biological, Radiological, Nuclear, and Explosive)	3.72	1.01
Symptom of PTSD for age groups 5–12 years, 13–17 years and adults	3.41	1.23
11 Accessing Critical Resources		
The appropriate agency to which reportable disease are to be directed	3.45	1.04

Pre- Delphi

Translation and modification of EPIQ tool. 45 items expanded to 59

Round I

53 of 59 statements reached consensus. 2 of the 6 that did not reach consensus reformulated as new statements

Round II

A total of 23 statements (4 statements from round I plus 19 new statements) sent out. 16 reached consensus

Round III

n=7 items. 1 reached consensus. **n=69 total items reaching consensus.**

Fig. 1. Delphi flow chart.

consensus it is postulated that generalizability of the competencies that reached consensus in this study has not been compromised due to the slight adjustments of items approved by the expert group. Indeed, the adjustments may reflect the ever-changing conditions and challenges that currently face hospitals and health care providers. Several statements presented to the expert panel in round two pertained to guidelines, structures or routines that may be slightly more specific to study setting i.e. "Regarding the application of privacy act during a major incident", "The Mobile medical team's (medical team sent from hospitals to the scene of the incident) role and mission including routines for documentation". The results of this study are in line with previous findings [31,33], however it also adds to the list of specific competencies. Furthermore, findings of this study appear to indicate that many disaster competencies and an instrument based on them, may be relevant in international settings with only minor modifications for local routines and regulations required.

While the results of this Delphi-study reflect current knowledge and perceptions of disaster nursing competencies, the validity of the questionnaire constructed from the competencies identified in this study will be tested in a future study.

6. Limitations

A central component of the Delphi method is consensus level or level of agreement. While consensus levels tend to be between 70 and 80% [26] there is no universal consensus as to what the level should be. It is theorized that a higher level of consensus could result in a higher likelihood of correctly identifying competencies. True anonymity is not possible in a Delphi study in as much as the authors have knowledge of the individual experts and their answers. With the aim of encouraging participation, participants in the study were made aware of the other individual experts participating in the study but not how individuals responded, resulting in quasi-anonymity. In addition, the authors were aware of the fact that some of the experts knew each other, possibly resulting in informal discussions concerning the study.

EPIQ was a useful starting block in identifying essential competencies as exemplified by the majority of items reaching consensus. The EPIQ tool was constructed in the United States for general RNs. It is possible that existing conditions at the time may not entirely harmonize

with preconditions at the time of this study. Since its construction, EPIQ has since been tested for validity and reliability, modified [33,32] and used in international settings [45]. However, while EPIQ has been utilized and tested, pre-conditions motivated the need to not simply translate the questionnaire but to critically review and adjust EPIQ for the current setting. After comparing the EPIQ questionnaire to Sweden's specific risk and hazards report [46] as well as the now defunct National Board of Health and Welfare's description of RN's competencies [17] and deeming it to be broadly representative for Swedish ED RNs, attention was turned to construction of statements. Items were expanded in an effort to create a more concise and sensitive tool as well as facilitate understanding items. While generalizability of the results may be difficult, the inclusion of international experts attempts to ensure that international perspectives were not lost, thereby strengthening transferability of the results of this study.

7. Conclusion

Within the realm of disaster medicine, specific competencies for ED nurses may slightly differ between countries despite many of the challenges and threats being similar. However, the content of competencies that reached consensus of the expert group imply that these 62 disaster nursing competencies may have clinical relevance in a variety of settings.

The results of this study are in line with earlier reports identifying a plethora of situations that may threaten morbidity and mortality on large scales and that ED RNs need to have a broad base of competencies for mitigating the effects of a MI or disaster.

The competencies identified in this study lend weight to previous studies identifying disaster medicine competencies as well as possibly updating them. In addition, the results may provide the basis for further investigation concerning disaster preparedness among emergency department RNs, thereby facilitating the identification of knowledge gaps and thus enable targeted training.

7.1. Clinical implications

Results from this study will serve as a basis for future studies on the disaster medicine competencies of RNs working at EDs. A first step in

improving disaster medicine preparedness is assessing current status through measurable competencies. This study provides measurable competencies and may identify areas where improvement is required that could then be defined and targeted by educational and training efforts thereby increase disaster preparedness. In addition, the findings, while intended for registered nurses, may also be of value for other medical professionals.

Availability of data

The data used in this study is available in reasonable request through the corresponding author.

Author's contribution

All authors contributed to the design, data collection, analysis, and revisions[*]. All authors are in agreement concerning the contents of the manuscript.

[*]Due to unforeseen and extenuating circumstances, the author, AD was unable to participate in final analysis and subsequent revisions.

Ethics declaration

Principles as stated in the World Medical Association Declaration of Helsinki as well as Swedish rules regarding ethics approval were adhered to. Participants were informed of and assured anonymity and confidentiality concerning the information rendered from this study.

Conflicts of interest disclosure

The authors declare there is no conflict of interest.

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