Overestimated, still less than competent: A cross-sectional study concerning emergency department registered nurses' disaster preparedness

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Abstract

Background

Major incidents continue to pose a threat to health care systems by overwhelming them with a sudden surge of patients. A major factor impacting a hospital's surge capacity is the skills, abilities, and knowledge of emergency department registered nurses. The level of disaster nursing competency they possess affects patient safety and outcome. ED RNs' ability to accurately assess their competency and knowledge is imperative for mitigating the effect of major incidents. ED RN's perception of overall disaster preparedness has not been thoroughly addressed. The aim of this study was to assess emergency department registered nurses' self-perceived disaster preparedness.

Method

The study was a cross-sectional study. A self-assessment questionnaire based on the results of a study identifying specific disaster nursing competencies for emergency department registered nurses was distributed to all emergency department registered nurses at six participating hospitals between January 10th to February 19th of 2019. A five-point Likert-type scale was used to assess competency.

Results

Emergency department registered nurses' disaster preparedness according to the Total Disaster Competency mean, was low. Furthermore, the results indicate that ED RNs' overestimate their disaster nursing competency when compared to the Total Disaster Competency score. When asked to estimate their overall the mean was "less than competent" yet higher than the Total Disaster Competency score. Knowledge gaps concerning disaster preparedness plans were also identified. Additionally, this study identified factors associated with disaster preparedness and self-assessment ability.

Conclusion

 ED RNs' overestimate their disaster preparedness and may lack self-awareness concerning their disaster competencies. However, ED RNs with formal disaster education appeared to have better insight concerning their preparedness. Clinical experiences, higher levels of education, and training were positively associated with preparedness. A lack of self-awareness may negatively impact patient outcomes during a major incident.

Background

Major incidents (MI) threaten to overwhelm the health care system by causing a sudden surge of patients in need of health care, [1-5]. Hospitals play critical roles in providing care during MIs [6, 7]. Vital strategic measures include increasing facilitating surge capacity through the allocation of resources, level of hospital response, and activating alternative, time-effective triage systems [8, 9]. Hospital's surge capacity is determined by several factors (staff, stuff, structure, and system,). In relation to staff, front line

responders, such as emergency department (ED) registered nurses' (RN) skills, knowledge and abilities are essential for providing quality care and minimizing excess morbidity and mortality [10-12]. A sudden surge of patients to EDs places responsibility on frontline responders often requiring RNs to quickly adapt to meet needs from a wide variety of events as stipulated by the all-hazards approach utilized in disaster response plans [9, 13]. ED RNs often hold strategic managerial positions in the disaster management plan, emphasizing the nurses' roles in disaster response [12].

Disaster nursing

The International Council of Nurses (ICN) recognizes the importance of nurses' disaster competency in mitigating the effects of MIs, by outlining general disaster core competencies, and emphasizing the need for specific disaster core competencies [13, 14]. Disaster nursing is defined as the ability to apply and adapt the application of competencies to a large variety of events with limited resources to mitigate the effects of an MI [14]. Registered nurses constitute the largest group of medical professionals and emergency department RNs are among the first to receive, assess, and treat victims from a major incident. Thus, underscoring ED RNs' role in patient safety [4, 15]. It is generally recognized that ED RNs' disaster competencies, during and after a major incident are crucial [14, 16]. ED RNs' ability to accurately assess their competency, knowledge gaps and needs is imperative for patient outcomes [17].

National doctrines and health organizations stipulate the need to both develop disaster medicine competencies for a broad range of possible incidents and evaluating preparedness [18, 19]. Despite its importance, little attention has been given to evaluating ED RNs' disaster nursing competencies possibly. Evidence supports that self-assessments, although subjective are a valid measurement of competency and are often used to evaluate RN clinical competency[17, 20]. Previous studies employing self-assessment instruments to evaluate RNs' disaster preparedness have reported moderate to low levels of disaster preparedness [21-27]. However, ED RNs' perception of overall disaster preparedness has not been addressed. There are to our knowledge, no prior studies assessing ED RNs' perceptions of their disaster competencies in relation to disaster preparedness and as measured by an instrument constructed specifically for ED RN's.

Aim

The aim of the current study was to assess emergency department registered nurses' self-perceived disaster preparedness.

Methods

Study design: A cross-sectional study using descriptive and inferential statistics.

Participants and Setting:

All seven major emergency departments in the region of Stockholm, Sweden were invited to participate. Six accepted. The study period was January 10th to February 19th of 2019. Inclusion criteria were all emergency department registered nurses employed at the respective Eds. Nurses employed by independent staffing agencies were excluded due to them not having an email address connected to the hospital.

The questionnaire

The questionnaire used to evaluate preparedness was a questionnaire based on competencies essential for RNs working in the ED during an MI as identified through expert consensus [28]. The questionnaire had three parts; 9 items concerning general background, 60 items relating to self-assessment, and two questions relating to knowledge of surge and disaster response. The 60 items concerning nurses' self-assessed disaster competencies used a five-point Likert-type scale. The self-assessment scale, which corresponded to Benner's stages of clinical competence (1=Novice, 2= Advanced beginner, 3= Competent, 4=Proficient, 5= Expert [29]) was explained and defined in the questionnaire.

A pilot study was conducted with registered nurses enrolled in emergency nursing and ambulance masters' programs at Sophiahemmet University. The aim of conducting the pilot study was to assess comprehension of the items, understanding of the Likert-type scale used as well as to assess the amount of time required to complete the questionnaire. A total of 15 questionnaires were completed. Participants suggested adjustment of some of the wording of the items to aid in clarity. The questionnaire took between 7-20 minutes to complete. The authors analyzed feedback and edited items to decrease lexical ambiguity.

Data collection

An email with information detailing the study and a link to the questionnaire was sent to hospital managers for distribution. Hospital managers then mailed the information and link to ED RNs. Data collection was completed using a closed link to Google Forms® which was emailed to the participants. The questionnaire was closed two weeks after a third reminder.

Data analysis

Data from the online questionnaire was first transferred to Microsoft® Excel® for Office 365, coded and then imported to IMB® SPSS® version 26.0 for analysis. To explore possible underlying relationships of items, or variances between items measuring competency, an exploratory factor analysis was conducted [30]. Internal reliability of the instrument was assessed using Cronbach's α. In addition to descriptive statistics, the Mann-Whitney u-Test, Kruskal-Wallis, were used to assess differences between groups and means. Correlation analysis was conducted using spearman's tau-b correlation and chi-squared.

The response alternative "uncertain" was treated as user missing data resulting in dichotomization of prior MI response experience, disaster medicine education at the bachelor's level, and education level

(bachelor and advanced). This also reduced the number of categories for "frequency of training" from five to four.

Ethical Considerations

Ethics approval was obtained by the Swedish Ethical Review Authority Diary number 2018/2142-31. Each participant was provided a description of the study and informed that participation was voluntary, and anonymity assured.

Results

Background data

Seven hospitals were invited to participate; one declined. The study population according to ED management was comprised of a total of 372 registered nurses employed at the six participating emergency departments. A total of 140 nurses answered the questionnaire resulting in a response rate of 38% (n=140/372). The majority of the nurses (70.4%) were between the ages of 26-44. 65% percent of nurses had more than five years of nursing experience. 40% percent of the participants reported having prior major incident experience. 30% of the registered nurses had advanced degrees within a variety of specialties. In addition, 54.6% of registered nurses had disaster medicine as a part of their bachelor's curriculum (Table 1).

Table 1 Demographic data n=140

		n	%
Gender	Female	109	77.9
	Male	31	22.1
	Total	140	100
Age	20-25	12	8.6
	26-34	51	36.4
	35-44	48	34.3
	45-54	19	13.6
	55-65	10	7.1
	Total	140	100
Degree	Registered Nurse	98	70
	Specialist Nurse	42	30
Clinical experience			
	<1	7	5
	1-3	24	17.1
	3-5	18	12.9
	5-10	33	23.6
	10->20	58	41.4
Disaster medicine in bachelor's degree			
	Yes	79	54.6
	No	40	15
	Uncertain	21	28.6*
Clinical experience during major incident?			
	Yes	56	40
	No	72	50.7
	Uncertain	13	9.3*
Frequency of disaster training at place of work			
	<1 year	45	32.1

	Once a year	34	24.3
	2 or more/ year	19	13.6
	Uncertain	22	15.7*
	Never	20	14.3
Instructor			
	Yes	35	25
	No	105	75

*Recoded as user missing data for analysis

Exploratory factor analysis

The exploratory factor analysis resulted in three sub-dimensions and one main dimension. The first subdimension consisted of 28 items related to "Staff, Stuff, Structure, System", (α= 0.98). The second consisted of 10 items related to Chemical, Biological, Radiological, and Nuclear (CBRN) competencies (α= 0.97), and the third consisted of 8 items relating to specific patient groups (α= 0.95) (see additional file1). These three subdimensions together create the main dimension, Total Disaster Competency.

Internal reliability for the questionnaire as expressed by Cronbach's alpha was α=0.989 (see additional file 2).

ED RNs' knowledge

56% (n=75/135) correctly answered that their ED had alternative systems for triage. 42 %(n=58/139) of the nurses correctly answered that level of care for patients was not automatically lowered when the HICG declared "state of disaster".

Nurses' disaster competency

The mean for Total Disaster Competency was 2.34. Means for the three subdimensions were 2.89 (Staff, Stuff, Structure, System), 2.00 (CBRN), and 2.17 (Specific patient groups) (Table 4). The final item assessed nurses' perception of their overall disaster preparedness. Nurses rated their competency statistically significantly higher (M=2.74) than the Total Disaster Competency (M=2.34, ρ=.000) (Table 2).

Table 2

Means per dimension		
	Mean	Std. Deviation
Stuff, staff, structure, system	2.89	1.03
CBRNE	2.00	0.93
Specific patient groups	2.17	1.00
Total Disaster Competency	2.34	0.92
Self-perceived overall disaster competency	2.74	1.14

There were significant differences in means for all dimensions based on several factors as exemplified by the means for Total Disaster Competency; Means for level of education (bachelor's degree M=2.03 advanced degree M=3.07 ρ=.000), clinical experience, (1-3 years M= 1.67, over 10 years M= 2.99 ρ=.000), being an instructor (M=2.98 vs 2.13 ρ=.000) having prior MI experience (M=2.68 vs M=2.08) , and having formal disaster medicine education (M= 2.10 vs 2.61 ρ=.000). There were no significant differences based on gender. (Table 3).

Table 3 Means and standard deviations for dimensions and factors

	Surge	CBRNE	Specific Patient groups	Total Disaster Competency Score	Perceived disaster competency
	Mean SD	Mean SD	Mean SD	Mean SD	Mean SD
Gender					
Female	2.95 ± 1.03	2.02 ± 0.92	2.19 ± 0.97	2.38 ± 0.9	2.77 ± 1.14
Male	2.67 ± 1.03	1.91 ± 0.94	2.12 ± 1.09	2.23 ± 0.99	2.61 ± 1.17
Test and significance	U=1194 ρ=0.21	U=1461.5 ρ=.063	U= 1429.5 ρ=0.53	U=1510.5 ρ=0.36	U=1539 ρ=0.43
Registered Nurse	2.55 ± 0.91	1.72 ± 0.74	1.84 ± .082	2.03 ± 0.77	2.38 ± 1
Specialist	3.61 ± 0.9	2.65 ± 1.01	2.96 ± 0.94	3.07 ± 0.77	3.57 ± 1.03
Test and significance	U=681 ρ=0.000	U=857 ρ=0.000	U=728 ρ=0.000	U=739 ρ=0.000	U=876 ρ=0.000
Professional experience					
<1	1.22 ± 0.14	1.05 ± 0.07	1.08 ± 0.18	1.12 ± 0.11	1.14 ±.0.37
1-3	2.07 ± 0.82	1.47 ± 0.58	1.64 ± 0.82	1.67 ± 0.67	2.00 ± 0.98
3-5	2.43 ± 0.94	1.67 ± 0.66	1.67 ± 0.71	1.9 ± 0.74	2.28 ± 1.17
5-10	2.82 ± 0.74	1.17 ± 0.79	1.98 ± 0.84	2.2 ± 0.71	2.45 ± 0.79
10 and over	3.61 ± 0.74	2.65 ±0.87	2.81 ± 0.9	2.99 ± 0.76	3.53 ± 0.86
Test and significance	KW 57,7	52,452	44,67	KW 62,712 ρ=0.000	KW 56,646 ρ=0.000

	ρ=0.000	ρ=0.000	ρ=0.000		
Disaster medicine course					
Yes	2.58 ± 1.05	1.82 ± 0.93	1.88 ± 0.99	2.10 ± 0.95	2.41 ± 1.14
No	3.19 ± 0.88	2.17 ± 0.8	2.50 ± 0.89	2.61 ± 0.78	2.63 ± 0.78
Test and significance	U= 837 ρ=0.002	U=969 ρ=0.007	U=845 ρ=0.000	U=982 ρ=0.001	U= 1031 ρ= <0.001
Instructor					
Yes	3.53 ± 0.99	2.66 ± 0.78	2.79 ± 0.98	2.98 ± 0.89	3.43 ± 1.06
No	2.67 ± 0.99	1.78 ± 0.78	1.98 ±0.93	2.13 ± .083	2.50 ± 1.08
Test and significance	U=769.5 ρ=0.000	U=808.5 ρ=0.000	U=872= ρ=0.000	U=879 ρ=0.000	U=1006 ρ=0.000
Prior major incident experience					
Yes	3.29 ± 1.00	2.40 ± 0.98	2.44 ± 1.04	2.68 ± 0.95	3.20 ± 1.11
No	2.61 ± 0.98	1.70 ± 0.78	1.92 ± 0.93	2.08 ± 0.84	2.35 ± 1.03
Test and significance	U=1004.5 ρ=0.001	U=994.0 ρ=0.000	U=1247.5 ρ=0.003	1253.0 ρ=0.000	1152 ρ=0.000
Frequency of training					
None	2.43 ± 0.66	1.72 ± 0.67	1.90 ± 1.02	2.04 ± 0.75	2.35 ± 0.98
< 1 x year	3.02 ± 0.86	1.94 ± 0.80	2.20 ± 0.93	2.36 ± 0.82	2.69 ± 1.01
1 x year	3.27 ±	2.20 ±	2.40 ± 0.88	2.58 ± 0.88	3.09 ± 1.11

	0.97	0.91			
≥2 x year	3.48 ± 1.20	2.64 ± 1.29	2.40 ± 1.27	2.86 ± 1.19	3.21 ± 1.39
Test and significance	KW 12.09 **ρ=.007**	KW 5.86 ρ=0.118	KW 4.03 ρ=0.258	KW 8.21 **ρ=<0.042**	KW 8.18 **ρ=<0.042**

Factors correlated to Total Disaster Competency

Professional clinical experience (r=.688), followed by higher education (r=.488), being an instructor (r=.391) prior MI experience (r=.318), and formal disaster medicine education (r=.-310) were in decreasing order correlated with Total Disaster Competency (Table 4).

These same factors were significantly correlated with RNs' perception of their overall disaster preparedness. The mean score of their perceived preparedness tended to increase with professional clinical experience (r= .623), level of education (r=.470), and prior MI experience (r=.373), except for formal disaster medicine education which decreased (r=-.293). RNs without formal disaster medicine education assessed their preparedness significantly higher than RNs with formal disaster medicine education (M= 3.08 vs 2.41 ρ =.004).

Table 4

Correlation of demographic factors and disaster competencies

Spearman's rho					
	Surge	CBRN	Specific patient groups	Total disaster competency score	Perceived overall disaster preparedness
Gender	-.110ns	-.042ns	-.054ns	-0.76 ns	-0.06ns
Education level	.479**	.415**	.478**	.488 **	.470**
Professional experience	.669**	.614**	.572**	.668 **	.623**
Disaster medicine course	-.298**	-.256**	-.337**	-.310**	-.293**
Instructor	.368**	.366**	.330**	.391**	.350**
Prior major incident experience	.321**	.375**	.269**	.318**	.373**
Frequency of training	-.081ns	.018ns	-.066ns	-.041ns	-.015ns

*Correlation is significant at the 0.05 level (2-tailed).**Correlation is significant at the 0.01 level (2-tailed).

A correct answer in relation to alternative triages systems was positively correlated with education (ρ=.007). 73.3% of the RNs with advanced degrees answered correctly as compared to 47.9% with bachelor's degrees answering correctly. In addition, frequency of training was also positively correlated (ρ=.000) to a correct answer concerning alternative triage systems (Table 5). There was no correlation between underlying factors such as education and correctly answering the question concerning how hospital response (state of disaster) affects level of care (table 6).

Table 5. Correlation of nurses' knowledge of their hospital's alternative triage. χ^2

	Correct (%)	Incorrect (%)	Chi square test
Level of education			
Bachelor's degree	45(47.9)	49 (52.1)	χ^2 (1) =7.4 **ρ= .007**
Advanced	30 (73.2)	11 (26.8)	φ = 0.234 n= 135
Frequency of training at workplace			
<1/ year	24 (36.9)	20 (41.7)	χ^2 (4) = 19.12
1 x / year	23 (35.4)	8 (16.7)	**ρ = .000**
2 or more / year	14 (21.5)	4 (8.3)	φ= 0.402
Never	4 (6.2)	16 (33.3)	n= 113

Table 6. Comparisons of demographic data participant's knowledge of how level of standard of care is affected by hospitals state of response

	Correct (%)	Incorrect (%)	Chi square test
Level of education			
Bachelor's degree	38 (39.2)	59 (60.8)	χ^2 (1) =0.858 ρ= .354
Specialist	20 (47.6)	22 (52.4)	φ = 0.07 n= 139
Frequency of training at workplace			
<1/ year	20 (44.4)	25 (55.6)	χ^2 (4) = 7.71 ρ = .103 φ= 0.236 n= 139

Result Discussion

The main result of the current study was that nurses appear to overestimate their overall preparedness for working during a major incident. Nurses' perception of their preparedness was "less than competent" according to Benner's stages of clinical competence. However, this was significantly higher than the Total Disaster Competency score which was closer to "advanced beginner" than "competent".

Self-assessment of competency for rare events may impact evaluation

Means for the three subdimensions indicate that disaster preparedness was "less the competent". A possible explanation for the low means may be that ED RNs rarely are exposed to certain situations or medical conditions. For example, many of the components that make up the subdimension with the highest mean (2.89) "Staff, Stuff, Structure, System" may more closely mirror many of the competencies ED RNs incorporate during normal circumstances. In contrast, competencies related to infrequent events such as chemical spills, pandemics, biological, and radiological events were lower (2.00) "CBRN" than the other two subdimensions.

Similarly, many ED RNs in the current study have limited contact with pediatric patients. This may explain the lower mean (2.17) for the subdimension "specific patient groups". While RNs in this study may be aware that they lack pediatric competency, this may also indicate both a discrepancy between experience and knowledge. For example, under normal circumstances, pediatric patients are referred to specific hospitals for care, which minimizes nurses' contact with these age groups. However, during an MI, regular routines may be circumvented. Previous studies have indicated that hospitals closest to the incident sight may receive a majority of patients from the incident. ED RNs may receive patients of various ages and medical conditions within minutes of an incident and often before hospitals have been alerted [3-5]. This may further highlight a gap between knowledge and experience.

According to the results in the current study, ED RNs may erroneously assume that normal standards and regulations apply under extraordinary circumstances, possibly negatively affecting patient outcomes.

Further affecting self-assessment in this study, is that RNs were asked to assess their competency for MIs, events that the majority had little or no experience with. This may lead to RNs neglecting to account for factors such as stress when assessing abilities [31] and increase the likelihood of overestimating abilities. In addition to possibly indicating the competency is lower than measured, the lack of self-awareness may impede an active pursuit to fill knowledge gaps, improve or maintain necessary skills, which may negatively impact patient outcome during an MI [32-34].

Knowledge of triage and levels of hospital response

A lack of self-awareness is a well-known phenomenon. Prior studies show little or no correlation between perceived ability and reality [32-34].

Knowledge concerning basic principles of surge capacity and disaster response plans are prerequisites for an adequate hospital response and patient care during an MI. A large portion of the RNs in the current study had knowledge gaps concerning fundamental aspects of hospital response and surge capacity. All

hospitals in the current study have disaster response plans as stipulated by law [35]. However, based on the results, nurses seem to incorrectly assume that the level of care is lowered when the hospital response level is raised to the state of disaster. This raises a concern for patient safety and may have legal ramifications since current legislation does not explicitly allow for health care to lower the level of care. Furthermore, nurses appear to not fully understand their hospital's surge capacity plan as assessed by the question concerning alternative triage systems. It is essential that RNs possess knowledge of their hospital's surge capacity and can apply it since patient volume during an MI may exceed an ED departments' normal daily volume within a few hours [3]. The current results indicate that ED RNs may be ill-prepared to facilitate surge capacity particularly during rare events such as MIs.

Factors associated with ED RN preparedness

While having an advanced degree was positively correlated to higher levels of competency, having formal disaster medicine education was negatively associated with competency. This apparent paradox may be explained in part by the Dunning-Kruger effect in which participants may overestimate their abilities due to a lack of self-awareness [36]. Yet another explanation may be that those with higher levels of expertise more accurately assess their abilities [17]. Their perception more closely mirrored reality, reflecting previous studies correlating accurate self-assessments with higher levels of expertise. [17].

Improved ED RN disaster preparedness may be achieved through frequent exercises and interactive training where skills and knowledge are evaluated.

Limitations

Competencies are comprised of skills, knowledge, and ability. Measuring competencies present challenges. A limitation of the current study is that competencies are measured using self-assessment. The validity of self-assessments is an oft-discussed topic with particular focus on the correlation between self-assessments and actual ability [31]. There is evidence suggesting that self-assessments may be valid measurements of ability, correlating accuracy of self-assessments with expertise [17, 20].

Another factor affecting the validity of self-assessments is the risk of participants' subjective interpretation of questions or terms used to measure competency[37]. Many studies apply Likert-type scales to assess self-evaluation of preparedness using measurements such as "how familiar" or "to what degree"[21, 23]. Lexical ambiguity of key terms or lack of participants' mutual understanding of the scale used, may inhibit accurate measurements and negatively affect the reliability and validity of the results. The current study reduced the ambiguity of key terms by using a scale of measurement that was clearly defined in the questionnaire. The study population in this study is occupationally homogeneous which may mutual understanding [38]. This mutual understanding motivated the use of Benner's stages of clinical competence in the current study to aid in self-assessment. By clearly correlating the five-point Likert-type with the five stages of competence corresponding with a five-point Likert scale [29] lexical ambiguity may have been minimized and RNs' mutual understanding of the scale used increased, thereby increasing the validity of the results and the transferability of the results.

The internal consistency was high (α = 0.989) and was higher than previous studies using similar instruments [23–25]. The reduction to three dimensions plus the added clarity of scales and items may have been a contributing factor for the high level of internal reliability and indicate that this instrument is a psychometrically sound questionnaire for assessing registered nurses' self-assessed disaster preparedness.

A second limitation of this study is that data is treated at interval data. This was done to make results comparable with previous research and to more accurately reflect subtle yet important differences.

The generalizability of the results may be questionable due to the relatively low response rate. Participation may have been negatively impacted by personnel being subjected to a large number of other studies at the time of the study. However, the response rate is of the same proportion as prior studies [25–27]. This may have been a reason one of the emergency departments opted to not participate in the study.

Conclusions

The current study indicates that ED RNs may overestimate their disaster preparedness. Although overestimating their preparedness, they assessed their overall preparedness as "less than competent". Registered nurses with formal disaster medicine education may have a more realistic view of their competencies and preparedness. While experience, training, and education correlated with disaster preparedness, the results indicate ED RNs with advanced degrees may be better prepared. However, ED RNs may be ill-prepared to facilitate for the challenges MIs present.

Abbreviations

ED
Emergency department
MI
Major incident
RN
Registered nurse

Declarations

Ethics approval and consent to participate

All representatives of the respective hospitals and participants were informed of the study in written form. Participants were guaranteed confidentiality and informed that their participation was voluntary, and they could at any time withdraw without consequences.

Ethics approval applied for and received a waiver by the Swedish Regional Ethical Review Board. (Diary number 2018/2142-31).

Consent for publication

Not applicable

Availability of data

The questionnaire, datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare they have no competing interests.

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Author's contributions

All authors contributed to the design, conception, and planning of the study. Data collection: JM, TR, and SM. Initial data analysis, interpretation and conclusions were done by JM. All authors contributed to the results. The first draft was written by JM with LK, MR, and AR aiding in the revision of the final manuscript. All authors have read and approved the final manuscript.

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References

1. Waxman DA, Chan EW, Pillemer F, Smith TW, Abir M, Nelson C: Assessing and Improving Hospital Mass-Casualty Preparedness: A No-Notice Exercise. *Prehosp Disaster Med* 2017, 32(6):662-666.

2. Ben-Ishay O, Mitaritonno M, Catena F, Sartelli M, Ansaloni L, Kluger Y: Mass casualty incidents - time to engage. *World journal of emergency surgery : WJES* 2016, 11:8.

3. The Committee for Disaster Medicine Studies: The Terror Attacks in Madrid, Spain 2004, KAMEDO Report 90. In. Stockholm, Sweden: The National Board of Health and Welfare; 2007: 72.

4. Turegano-Fuentes F, Perez-Diaz D, Sanz-Sanchez M, Ortiz Alonso J: Overall Asessment of the Response to Terrorist Bombings in Trains, Madrid, 11 March 2004. *European journal of trauma and emergency surgery : official publication of the European Trauma Society* 2008, 34(5):433.

5. Leiba A, Blumenfeld A, Hourvitz A, Weiss G, Peres M, Laor D, Schwartz D, Arad J, Goldberg A, Levi Y *et al*: Lessons learned from cross-border medical response to the terrorist bombings in Tabba and Ras-el-Satan, Egypt, on 07 October 2004. *Prehosp Disaster Med* 2005, 20(4):253-257.

6. Naser WN, Ingrassia PL, Aladhrae S, Abdulraheem WA: A Study of Hospital Disaster Preparedness in South Yemen. *Prehosp Disaster Med* 2018, 33(2):133-138.

7. Djalali A, Castren M, Khankeh H, Gryth D, Radestad M, Ohlen G, Kurland L: Hospital disaster preparedness as measured by functional capacity: a comparison between Iran and Sweden. *Prehosp Disaster Med* 2013, 28(5):454-461.

8. Curran-Sills G, Franc JM: A pilot study examining the speed and accuracy of triage for simulated disaster patients in an emergency department setting: Comparison of a computerized version of Canadian Triage Acuity Scale (CTAS) and Simple Triage and Rapid Treatment (START) methods. *Cjem* 2017, 19(5):364-371.

9. Regional Disaster Medicine Preparedness Plan for Stockholm, Swedem (Regional katastrofmedicinsk beredskapsplan för Stockholm läns lansting). In. Edited by Unit for Disaster Medicine Preparedness S, Sweden. (EKMB). Stockholm, Sweden; 2017.

10. Schultz CH, Koenig KL: State of research in high-consequence hospital surge capacity. *Academic emergency medicine : official journal of the Society for Academic Emergency Medicine* 2006, 13(11):1153-1156.

11. Hick JL, Barbera JA, Kelen GD: Refining surge capacity: conventional, contingency, and crisis capacity. *Disaster medicine and public health preparedness* 2009, 3(2 Suppl):S59-67.

12. Veenema TG, Deruggiero K, Losinski S, Barnett D: Hospital Administration and Nursing Leadership in Disasters: An Exploratory Study Using Concept Mapping. *Nursing administration quarterly* 2017, 41(2):151-163.

13. Langan JC, Lavin RP, Griffin AR, Veenema TG, Dobalian A: From Brainstorming to Strategic Plan: The Framework for the Society for the Advancement of Disaster Nursing: A Work in Progress. *Nursing administration quarterly* 2019, 43(1):84-93.

14. International Council of Nurses: Core Competencies in Disaster Nurse. Version 2.0. In. Geneva, Switzerland: ICN - International Council of Nurses; 2019.

15. World Health Organization: WHO global Health workforce statistics. In.; 2018.

16. Veenema TG, Griffin A, Gable AR, MacIntyre L, Simons RN, Couig MP, Walsh JJ, Jr., Lavin RP, Dobalian A, Larson E: Nurses as Leaders in Disaster Preparedness and Response–A Call to Action. *Journal of nursing scholarship : an official publication of Sigma Theta Tau International Honor Society of Nursing* 2016, 48(2):187-200.

17. Judge TA, Jackson CL, Shaw JC, Scott BA, Rich BL: Self-efficacy and work-related performance: the integral role of individual differences. *The Journal of applied psychology* 2007, 92(1):107-127.

18. Swedish Civil Contingencies Agency: National Risk and Ability Assessment 2019. In.; 2019.

19. Center for Disease Control: Public Health Emergecny Preparedness (PHEP)Cooperative Agreement In.; 2020.

20. Cole M, J. , Zhang X, Jinging L, Liu C, Belkin NJ, Bierig R, Gwizdka J: Are Self-Assessments Reliable Indicators of Topic Knowledge? *Proceedings of the American Society for Information Science and Technology* 2010, 47(1-10).

21. Nilsson J, Johansson E, Carlsson M, Florin J, Leksell J, Lepp M, Lindholm C, Nordstrom G, Theander K, Wilde-Larsson B *et al*: Disaster nursing: Self-reported competence of nursing students and registered nurses, with focus on their readiness to manage violence, serious events and disasters. *Nurse education in practice* 2016, 17:102-108.

22. Öztekin SD, Larson EE, Akahoshi M, Öztekin İ: Japanese nurses' perception of their preparedness for disasters: Quantitative survey research on one prefecture in Japan. *Japan journal of nursing science : JJNS* 2016, 13(3):391-401.

23. Garbutt SJ, Peltier JW, Fitzpatrick JJ: Evaluation of an instrument to measure nurses' familiarity with emergency preparedness. *Military medicine* 2008, 173(11):1073-1077.

24. Wisniewski R, Dennik-Champion G, Peltier JW: Emergency preparedness competencies: assessing nurses' educational needs. *The Journal of nursing administration* 2004, 34(10):475-480.

25. Hodge AJ, Miller EL, Dilts Skaggs MK: Nursing Self-perceptions of Emergency Preparedness at a Rural Hospital. *Journal of emergency nursing: JEN : official publication of the Emergency Department Nurses Association* 2017, 43(1):10-14.

26. Alzahrani F, Kyratsis Y: Emergency nurse disaster preparedness during mass gatherings: a cross-sectional survey of emergency nurses' perceptions in hospitals in Mecca, Saudi Arabia. *BMJ open* 2017, 7(4):e013563.

27. Baack S, Alfred D: Nurses' preparedness and perceived competence in managing disasters. *Journal of nursing scholarship : an official publication of Sigma Theta Tau International Honor Society of Nursing* 2013, 45(3):281-287.

28. Murphy JP, Radestad M, Kurland L, Jirwe M, Djalali A, Ruter A: Emergency department registered nurses' disaster medicine competencies. An exploratory study utilizing a modified Delphi technique. *Int Emerg Nurs* 2018.

29. Benner P: From Novice to Expert: Excellence and Power in Clinical Nursing Practice. Upper Saddle River: Prentice Hall; 2001.

30. Field A: Discovering Statistics Using Spss. London: Sage; 2013.

31. Dunning D, Heath C, Suls JM: Flawed Self-Assessment: Implications for Health, Education, and the Workplace. *Psychological science in the public interest : a journal of the American Psychological Society* 2004, 5(3):69-106.

32. Oskam J, Kingma J, Klasen HJ: Clinicians' recognition of 10 different types of distal radial fractures. *Perceptual and motor skills* 2000, 91(3 Pt 1):917-924.

33. Shah D, Haisch CE, Noland SL: Case Reporting, Competence, and Confidence: A Discrepancy in the Numbers. *Journal of surgical education* 2018, 75(2):304-312.

34. Castle N, Garton H, Kenward G: Confidence vs competence: basic life support skills of health professionals. *British journal of nursing (Mark Allen Publishing)* 2007, 16(11):664-666.

35. The National Board of Health and Welfare: Disaster Medicine Preparedness: Regulations and recommendations. In. Västerås, Sweden; 2013.

36. Dunning D: The Dunning-Kruger effect: On being ignorant of one's own ignorance. *Advances in experimental social psychology* 2011, 44:247-296.

37. Eddington CM, Tokowicz N: How meaning similarity influences ambiguous word processing: the current state of the literature. *Psychonomic bulletin & review* 2015, 22(1):13-37.

38. Wenger E: Communites of Practice: Learning, Meaning and Identify, sixth edn. Cambridge: Cambridge University Press; 1998.

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