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Research article

Nurses' knowledge, skills and preparedness for disaster management of a Megapolis: Implications for nursing disaster education

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ABSTRACT

As frontline health caregivers, nurses must be adequately prepared to respond effectively to disasters. Therefore, it is necessary to assess nurses' disaster management capacity to know their preparedness levels, especially for a densely populated Megapolis like Dhaka, which is at high risk of disasters. Thus, the study aimed to examine Dhaka city nurses' knowledge, skills, preparedness (KSP) for disasters and explore the factors influencing the KSP levels. A self-explanatory descriptive survey questionnaire was developed adopting the Disaster Preparedness Evaluation Tool (DPET) in Bangla language for quantitative data collection. Following multistage sampling, 410 nurses' data were collected from eight hospitals in Dhaka city. The nurses in Dhaka city had moderate levels of knowledge, skills, and preparedness for disaster management, reflecting that they need more development to deal with disasters effectively. Moreover, multiple linear regression analyses indicate that nurses' disaster knowledge, skills, and preparedness scores were significantly positively associated with training on disaster management ($p < 0.001$) and disaster response experience ($p < 0.001$). In addition, one-half of the respondents demanded more drills and exercises on disaster management in their workplaces to enhance their disaster skills and preparedness. Furthermore, disaster education should be incorporated into the nursing curriculum, which would play a seminal role in preparing them for future disaster management.

1. Introduction

Even though emergency nursing is a core component of effective disaster management, the nurses' perceived level of preparedness for disasters has not been evaluated in Dhaka city— ranked as the 19th populated city (15.4 million) and the highest densely populated city (33,900 per square kilometer) in the world (Cox, 2020), and the capital of Bangladesh. However, Bangladesh is one of the most vulnerable countries of the world, prone to disaster and climate change (Chowdhury et al., 2020; MoEF, 2009). It seems incredibly crucial for capitals and megacities like Dhaka that face frequent human-made disasters and are vulnerable to earthquakes, urban floods, fires, building collapses, road accidents, and epidemics. For example, in 2013, the collapse of the Rana Plaza garment factory in Dhaka killed at least 1132 people, and another 2500 were injured, which is one of the worst industrial accidents in the world (ILO, 2017). Besides, more than 16,000 fire incidents happened in Bangladesh from 2008 to 2018 (Dhaka Tribune, 2019). Dhaka is one of the most fire incident-prone districts in the country and witnessed several deadly fire incidents in recent years, such as the Nimtoli fire (2010) in old Dhaka killed 124 people (Molla, 2019), the Tampaco fire (2016) in Tongi killed at least 24 people (Nagesh, 2016), and the Chawkbazar inferno (2019) in old Dhaka killed 67 peoples (Molla, 2019). Moreover, high population density, unplanned and haphazard urbanization, inadequate healthcare services, high environmental degradation, and climate change impacts make the district more susceptible to disasters (Kabir et al., 2018). Furthermore, the rapid expansion rate of the megacity's periphery resulting from rural-urban migration and upward population growth indicates that resources are even more strained here (Jahan, 2012). Hence, people's lives and livelihoods in Dhaka city are increasingly vulnerable to urban disasters (Haque et al., 2018; Saha, 2018; Subrina and Chowdhury, 2018).

For effective disaster response, public health nurses must have the capacity to cope with the first responding duty (Cushman et al., 2019; Kaplan et al., 2012; Pourvakhshoori et al., 2017; Trangenstein et al., 2005; Yamamoto, 2013). For that reason, there should be a prime need to educate nurses about their necessary working procedures in a disaster scenario (Jennings-Sanders, 2004; Khankeh et al., 2007). Ironically, several studies show that nurses do not possess relevant competencies as

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needed in response to recent disasters (Al Khalaileh et al., 2012; Chapman and Arbon, 2008; Collander et al., 2008; Duong, 2009; Jiang et al., 2015; Slepski, 2007; Usher et al., 2015b; Usher and Mayner, 2011). Studies show that a few disaster preparedness and management courses have been proposed in Western and Australian nursing schools to prepare nurses for health emergency and disaster management (Slepski, 2007; Usher et al., 2015b); no such courses have been introduced in Middle Eastern countries such as Jordan (Al Khalaileh et al., 2012). Fung et al. (2008) found that 97% of registered nurse respondents in Hong Kong who had a Master's degree in nursing considered that they were not sufficiently prepared for serving at the time of a disaster.

In Bangladesh, public health nurses need to have a premeditated plan for responding to various emergencies and disasters (natural and human-made) that occur in the state. Nurses should serve an indispensable role in amplifying healthcare experiences (Al Khalaileh et al., 2012; Fung et al., 2008; Nasrabadi et al., 2007; Tichy et al., 2009; Yang et al., 2010), especially for pregnant women, new mothers, and newborn babies. This role extends to women's and infants' requirements during the emergency (Badakhsh et al., 2010). Thus, considering these public healthcare needs, agencies and nursing institutes should formulate and pursue a planning process — an uninterrupted cycle that engages: planning, organizing, equipping, guiding, training, practicing, evaluating, and developing a further plan for revisions (Putra et al., 2011). So that the nurses can be adequately prepared to respond effectively to disasters.

Several studies have been examined the nurses' disaster preparedness, predominantly utilizing cross-sectional research design using survey method with questionnaires (Ahayalimudin and Osman, 2016; Al Khalaileh et al., 2012; Al Thobaity et al., 2015; Brewer et al., 2020; Labrague et al., 2018; Martono et al., 2019; Öztekin et al., 2016; Rizqillah and Suna, 2018; Usher et al., 2015a; Younos et al., 2021). The researchers used various tools to measure nurses' disaster preparedness, and among them, Disaster Preparedness Evaluation Tool (DPET) was frequently used (Labrague et al., 2018; Martono et al., 2019; Öztekin et al., 2016; Rizqillah and Suna, 2018; Usher et al., 2015a; Younos et al., 2021). Usher et al. (2015a) measured the nurses' disaster preparedness in Asia-Pacific countries, including Bangladesh using the DPET tool. However, this study used a relatively small data set (only 200 Bangladeshi nurses were interviewed) to evaluate nurses' preparedness levels and found low-to-moderate levels of disaster knowledge, skills, and preparedness. Moreover, they did not mention where the data were collected. Therefore, more robust studies are needed to reexamine the level of disaster preparedness among Bangladeshi nurses in particular. Besides, several studies show that existing nursing educational modules and curricula do not adequately prepare nurses to respond to disasters (Fung et al., 2008; Jennings-Sanders, 2004; Martono et al., 2019; Slepski, 2007; Tichy et al., 2009; Usher et al., 2015a). In addition, Younos et al. (2021) studied Bangladeshi nurses' disaster preparedness by collecting data from three disaster-prone districts: Patuakhali, Sirajgong, and Sylhet. This study found that nurses perceived that they are moderately prepared to deal with disasters; however, considerable limitations of disaster management knowledge, skills, and education have been identified.

Moreover, to our best knowledge, no study yet focus on the disaster management knowledge and skills of nurses in Dhaka City, which is crucial to increase the capacity of emergency health management during crises and disasters of this megacity. Thus, the present study aimed to assess Dhaka city nurses' perception of their knowledge, skills, and preparedness for disasters and examine the socio-demographic factors that affect the nurses' disaster knowledge, skills, and preparedness (KSP). A descriptive cross-sectional survey was conducted among nurses in different hospitals in the study area for data collection. This study seeks to put into practice the first step toward nurses' disaster preparedness in Dhaka city. Furthermore, the study's findings may have important implications in strengthening emergency preparedness policy and education for nurses in Bangladesh.

2. Methods

2.1. Study design and settings

A descriptive cross-sectional survey method was used to explore nurses' perceptions of their knowledge, skills, and preparedness for disaster management in Dhaka city. Four public hospitals and four private hospitals in Dhaka city were selected purposively for this study. These eight hospitals regularly received emergency patients and sent their medical teams in response to disasters. The inclusion criteria for the study were: (1) nurses currently working in the hospitals, (2) nurses who have completed at least a three years' duration nursing-related degree, and (3) willing to participate in the survey voluntarily. All nurses who met the criteria were requested to participate in the survey.

2.2. Instrument

For the survey, we used a self-directed structured questionnaire that contains the modified Disaster Preparedness Evaluation Tool (DPET) (13 items for "knowledge," 11 items for "skills," and 21 items for "preparedness") (Tichy et al., 2009), fourteen socio-demographic questions such as age, gender, nursing education, nursing experience, types of nurse, type of hospital, disaster response experience, training on disaster management, and one open-ended question to ask the recommendations for improving nurses' disaster management capacity. Knowledge-related 13 items of DEPT tools pertained to disaster-related classes, seminars, journals and research, chain of command, participation in disaster plan drafting, and referral contacts (Table 3). Skills-related 11 items were focused on triage and leadership skills, isolation and decontamination process, and emergency plan for respondents' families (Table 4). Preparedness-related 21 items were pertained to nurses' abilities as a direct care provider, confidence in post-disaster care, and provide post-disaster health interventions (Table 5).

For this study, expert translators translated the DEPT tool in Bangla using the back translation method (Pym, 2009). The survey instrument was tested twice with two groups of nurses ($n = 15$ & 18) working at two different hospitals in Dhaka city, and after the first pretesting, slight modifications were made based on the feedback of the pilot groups; then, no further changes were made to the questionnaire before distribution. Participants' perceptions of disaster knowledge, skills, and preparedness were assessed using a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). The Cronbach's Alpha coefficient of the DEPT scale used in the questionnaire was 0.930, indicating a high internal reliability level (George and Malley, 2019) (Table 1).

2.3. Study sample

Before data collection, the sample size was calculated using the single population proportion formula. The formula is $n = \frac{Z^2\, p\, (1-p)}{d^2}$, where p is the proportion of nurses prepared for disasters and taken as 50% since there was no previous study. Z is the standard normal distribution value at $\alpha = 0.05$, and d is the margin of error (5%). Therefore, the required sample size was 384. We invited 459 nurses who met the survey criteria, and among them, 410 respondents were patricipate. The

Table 1
Reliability of the KSP scales using inter-item correlation (IIC).

	Mean	Variance	SD	Items (n)	IIC Score (Cronbach's Alpha)
Knowledge	39.69	72.17	8.50	13	0.822
Skills	34.16	61.21	7.82	11	0.837
Preparedness	75.00	128.30	11.33	21	0.880
Total	148.84	586.04	24.21	45	0.930

response rate was 89.32%.

2.4. Data analysis

Raw data were entered into and analyzed using IBM Statistical Package for the Social Sciences (SPSS) version 25.0 for Windows (SPSS, Chicago, IL, USA). Descriptive statistics were used to evaluate respondents' characteristics (Table 2). Perceived disaster knowledge, skills, and preparedness were calculated using the mean and standard deviation of the items and classified as: 1–2.33 = low, 2.34–3.66 = moderate, and 3.67–5 = high levels of disaster knowledge, skills, and preparedness scores (Tables 3–5). Significant mean differences between the respondents' characteristics and their level of knowledge, skills, and preparedness for disasters were assessed using Independent *t*-test and One-way ANOVA analysis (Tables A1 and A2 in the Appendix). Pearson correlation coefficient was used to measure the interrelationships between the level of knowledge, skills, and preparedness (Table 6), and multiple linear regression analysis was used to identify the significant predictors of nurses' disaster preparedness (Table 7). A *p*-value ≤ 0.05 was considered statistically significant. The thematic analysis was also used for open-ended questions.

Table 2
Socio-demographics characteristics of the nurse respondents in Dhaka city (n = 410).

Characteristics	Frequency	Percent
Sex		
Male	21	5.1
Female	389	94.9
Age (years)		
18 to 20	23	5.6
21 to 30	225	54.9
31 to 40	106	25.9
41 and above	56	13.7
Mean = 30.42; SD = 8.94		
Marital status		
Single	134	32.7
Married	270	65.9
Others[a]	6	1.5
General academic qualification		
Grade X	86	21.0
Grade XII	313	76.3
Honors	9	2.2
Masters	2	0.5
Nursing academic qualification		
BSc in Nursing	198	48.3
Associated degree[b]	212	51.7
Types of nurse		
Registered Nurse	274	66.8
Non-registered Nurse	85	20.7
Intern-student Nurse	51	12.4
Types of hospital		
Public	342	83.4
Private	68	16.6
Nursing experience (years)		
≤5	187	45.6
6-10	108	26.3
≥11	115	28.0
Mean = 8.59; SD = 7.65		
Having children		
Yes	226	55.1
No	184	44.9
Disaster response experience		
Yes	142	65.4
No	268	34.6
Disaster training experience		
Yes	93	22.7
No	317	77.3

[a] Widow, Separated.
[b] Diploma in Nursing, Diploma in Midwifery.

Table 3
Level of disaster management knowledge of the Dhaka city nurses[a].

Items	Mean	SD	N
I find that the research published work on disaster preparedness and management is easily accessible.	2.31	1.096	410
I have participated in emergency plan drafting and emergency planning for disaster situations in my community.	2.40	1.189	410
I participate in one of the following educational activities regularly: continuing education classes, seminars, or conferences dealing with disaster preparedness	2.66	1.257	410
I know where to find relevant research or information related to disaster preparedness and management to fill in my knowledge gaps.	2.76	1.134	410
Finding relevant information about disaster preparedness related to my community needs is an obstacle to my preparedness level.	2.88	1.154	410
I read journal articles related to disaster preparedness.	3.04	1.239	410
I am familiar with the local emergency response system for disasters.	3.06	1.184	410
I find that the research published work on disaster preparedness is understandable.	3.21	1.073	410
I know whom to contact (chain of command) in disaster situations in my community.	3.28	1.185	410
In case of a disaster situation, I think there is sufficient support from local officials on the county or state levels.	3.30	1.182	410
I am aware of classes about disaster preparedness and management that are offered, for example, at my workplace, the university, or the community.	3.31	1.123	410
I have a list of contacts in the medical or health community in which I practice. I know referral contacts in case of a disaster situation (e.g., health department).	3.31	1.221	410
I would be interested in educational classes on disaster preparedness that relate specifically to my community situation.	4.19	0.960	410
Mean ± SD	2.99 ± 0.66		

[a] Likert-type scale, ranging 1–5.

Table 4
Level of disaster management skills of Dhaka city nurses[a].

Items	Mean	SD	N
I participate/have participated in creating new guidelines, emergency plans, or lobbying for improvements on the local or national level.	2.44	1.200	410
I would be considered a key leadership figure in my community in a disaster situation.	2.67	1.143	410
In a case of bioterrorism/biological attack, I know how to perform isolation procedures to minimize the risks of community exposure.	2.70	1.221	410
In case of a bioterrorism/biological attack, I know how to execute decontamination procedures.	2.83	1.231	410
In case of a bioterrorism/ biological attack, I know how to use personal protective equipment.	2.85	1.159	410
I participate in disaster drills or exercises at my workplace (e.g., clinic, hospital) regularly.	2.98	1.222	410
I am familiar with accepted triage principles used in disaster situations.	3.32	1.175	410
I consider myself prepared for the management of disasters.	3.41	1.076	410
I have an agreement with loved ones and family members on how to execute my personal/family emergency plans.	3.52	1.137	410
I have personal/family emergency plans in place for disaster situations.	3.59	1.142	410
I am aware of the potential vulnerabilities in my community (e.g., earthquakes, floods, terror).	3.85	0.953	410
Mean ± SD	3.11 ± 0.71		

[a] Likert-type scale, ranging 1–5.

2.5. Ethical consideration

The study was conducted following the Bangladeshi data protection legislation as well as the Helsinki Declaration (WMA, 2018). Before the data collection, permission was taken from the respective directors of

Table 5
Level of preparedness for disaster management of Dhaka city nurses[b].

Items	Mean	SD	N
In case of a bioterrorism/biological attack, I know how to perform focused health history and assessment specific to the bio-agents that are used.	3.251	1.150	410
I feel confident discerning deviations in health assessments, indicating potential exposure to biological agents.	3.268	1.059	410
I am familiar with the main groups (A, B, C) of biological weapons (e.g., anthrax, plague, botulism, and smallpox), their signs and symptoms, and effective treatments.	3.285	1.105	410
I feel confident managing (treating, evaluating) emotional outcomes for acute stress disorder or PTSD[a] following disaster or trauma in a multidisciplinary way, such as referrals and follow-ups, and I know what to expect in the ensuing months.	3.293	1.059	410
I am familiar with the organizational logistics and roles among local, state, and federal agencies in disaster response situations.	3.305	1.010	410
I participate in peer evaluation of skills on disaster preparedness and response.	3.315	1.179	410
I can discern the signs and symptoms of acute stress disorder and PTSD.	3.337	1.138	410
I am familiar with how to perform focused health assessments for PTSD.	3.378	0.979	410
I can describe my role in the response phase of a disaster in the context of my workplace, the public, media, and personal contacts.	3.546	1.065	410
I would feel confident about implementing emergency plans, evacuation procedures, and similar functions.	3.556	0.981	410
As a Nurse, I would feel reasonably confident in my ability to be a decontamination team member.	3.620	0.975	410
I would feel confident working as a triage nurse practitioner and setting up temporary clinics in disaster situations.	3.651	0.968	410
I feel reasonably confident that I can treat patients independently without a physician's supervision in a disaster situation.	3.656	1.050	410
I would feel confident providing education on coping skills and training for patients who experience traumatic situations to manage themselves.	3.698	0.920	410
I am familiar with psychological interventions, behavioral therapy, cognitive strategies, support groups, and incident debriefing for patients who experience emotional or physical trauma.	3.732	1.002	410
I can identify possible indicators of mass exposure, evidenced by the clustering of patients with similar symptoms.	3.776	0.835	410
I would feel confident in providing patient education on stress and abnormal functioning related to trauma.	3.805	0.860	410
I can manage the common symptoms and reactions of disaster survivors that are of affective, behavioral, cognitive, and physical nature.	3.827	0.811	410
As a Nurse, I would feel confident as a manager or coordinator of a shelter.	3.883	0.899	410
I am familiar with the scope of my role as a nurse in a post-disaster situation.	3.895	0.944	410
As a Nurse, I would feel confident in my abilities as a direct care provider and first responder in disaster situations.	3.922	0.803	410
Mean ± SD	3.57 ± 0.54		

[a] PTSD (Post-traumatic stress disorder).
[b] Likert-type scale, ranging 1–5.

Table 6
Correlation between nurses' level of disaster knowledge, skills, and preparedness in Dhaka city.

	Knowledge	Skills	Preparedness
Knowledge	1		
Skills	0.725**	1	
Preparedness	0.595**	0.640**	1

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

each hospital. Before conducting the interview, each respondent was clearly informed about the study objectives, information coverage, confidentiality issues, and interview time. Besides, they were well informed about their rights to refuse to give the interview. Respondents' verbal consents were also being collected if they were willing to take part in the survey. Participation in this study was voluntary.

3. Results

3.1. Demographics

Among the 410 respondents, most of the nurse respondents were female (95%) and the mean age of the respondents was 30 years (SD = 8.94). Only 48.3% of respondents have a BSc in nursing degree, and about 83% of respondents worked in public hospitals. The majority of the respondents were registered nurses (RNs) (66.8%), followed by non-registered nurses (NRNs) (20.7%), and the rest (12.4%) were intern-students nurses[1] (ISNs) (12.4%). Two-third of the respondents had disaster response experience, and only 22% had training in disaster management (Table 2).

3.2. Disaster knowledge

Cronbach's Alpha of the "knowledge" section was 0.822, which indicates an acceptable level of internal consistency of the items (Table 1) (George and Malley, 2019). This section's mean value indicates that participants had a moderate level (M = 2.99, SD = 0.66) of disaster management knowledge. Participants were highly interested in attaining classes related to disaster management. However, they had minimal access to disaster-related publications, including journal articles (Table 3).

Independent sample *t*-tests showed that nurses working at private hospitals (M = 3.27) had more disaster management knowledge than the public hospital nurses had (M = 3.01; $p = 0.01$) in Dhaka city. In addition, respondents who had disaster response experience (M = 3.61) and training on disaster management (M = 3.75) had more disaster management knowledge than those who had no response experience (M = 2.67; $P = 0.001$) and no disaster management training (M = 2.85; $p = 0.001$). Analysis of variance showed that there were significant effects of the independent variables: age of the respondents (F = 3.65, $p = 0.05$), non-nursing academic qualification (F = 3.35, p = 0.05) on the dependable variable: level of disaster knowledge. The Scheffé post hoc criterion for significance indicated that respondents who completed up to Grade X (M = 2.98, SD = 0.75) had significantly lower knowledge on disaster management than the respondents who completed a Master's degree (M = 3.52, SD = 0.84), F(2,307) = 3.35, p = 0.05 (Table A2 in the Appendix).

3.3. Disaster skills

There were 11 DPET items related to disaster skills, and Cronbach's Alpha of this section was 0.837, indicating an adequate level of internal reliability (George and Malley, 2019). The mean scores of these items ranging from 2.44 to 3.85, indicating a moderate level of disaster management skills of the nurses in Dhaka city. Though nurses were aware of the disaster vulnerabilities in the communities, they were less confident about their crucial leadership roles in community disaster management nor frequently participated in developing new guidelines and emergency plans at local or national levels (Table 4).

Independent sample *t*-test showed that Dhaka city nurses who had

[1] Student nurses who have completed at least 3 years of their BSc nursing program and are currently doing their internship in different hospitals as a requirement of the degree. Usually, after completing their internship, they are joining a hospital as a nurse.

Table 7
Multiple linear regression of the Dhaka city nurses' level of disaster knowledge, skills, and preparedness (n = 410).

	Disaster knowledge		Disaster skills		Disaster preparedness	
	B	P	B	P	B	P
Constant	2.104	0.001***	2.302	0.001***	3.296	0.001***
Gender	0.101	0.379	0.107	0.389	−0.028	0.801
Age	0.053	0.255	0.054	0.281	0.031	0.492
Marital status	−0.094	0.237	−0.122	0.155	−0.004	0.955
Have children	0.029	0.734	−0.098	0.290	0.016	0.846
Academic (Nursing) Degree	0.108	0.070	−0.017	0.791	0.04	0.482
General Educational Degree	0.121	0.034*	0.151	0.014*	0.127	0.020*
Nursing Experience (Years)	0.006	0.892	0.106	0.032*	0.032	0.473
Types of Nurse	−0.032	0.525	−0.032	0.555	−0.072	0.136
Types of Hospital	0.206	0.003**	−0.033	0.652	−0.145	0.028*
Response Experience	0.531	0.001***	0.6	0.001***	0.372	0.001***
Training on DM	0.474	0.001***	0.526	0.001***	0.25	0.001***
Model F	30.99, df (11,398), p = 0.001***		32.33, df (11,398), p = 0.001***		13.90, df (11,398), $p = 0.001$**	
Adjusted R-square	0.446		0.457		0.258	

Note: Independent variables for the multiple linear regression include gender (Male = 0; Female = 1), age (18-20 years old = 1; 21–30 years old = 2; 31–40 years old = 3; 41 and above years old = 4), marital status (Single = 0; Ever married = 1), have children (No = 0; Yes = 1), nursing academic degree (Associated Degree = 0; Honors in Nursing = 1), general educational degree (Grade X = 1; Grade XII = 2; Honors = 3), nursing experience (5 and less years = 1; 6–10 years = 2; 11 and more years = 3), types of nurse (Registered Nurse = 1; Non-registered Nurse = 2; and Intern-student Nurse = 3), types of hospital (Public = 1; Private = 2), disaster response experience (No = 0; Yes = 1), and having training on disaster management (0 = No; 1 = Yes).

* P < 0.05.

** P < 0.01.

*** $P < 0.001$.

disaster response experience (M = 3.71) and training on disaster management (M = 3.88) had more skills for disaster management than nurses who had no disaster response experience (M = 2.78) and no training on disaster management (M = 2.88) (Table A1 in the Appendix). Moreover, results indicated that the effect of nursing experience (years) on disaster skills was significant, F(2,307) = 7.26, $p = 0.001$. Nurses who had more than 10 years of nursing experience (M = 3.31, SD = 0.69) had significantly higher disaster management skills than nurses who had 6 to 10 years of nursing experience (M = 3.02, SD = 0.62) and less than 5 years of nursing experience (M = 3.03, SD = 0.75) (Table A2 in the Appendix).

3.4. Disaster preparedness

There were 21 items related to disaster preparedness, especially preparation for post-disaster management. The Cronbach's Alpha of this section was 0.880, indicating adequate internal reliability (George and Malley, 2019). This section's mean value was 3.57 (SD = 0.54), indicating a moderate level of nurses' disaster preparedness. Respondents were less confident about their abilities to perform health assessments and health care in case of bioterrorism or biological attack than their abilities as direct care providers and first responders in disaster situations (Table 5). Nurses who had disaster response experience (M = 3.92) and training on disaster management (M = 3.99) had significantly higher disaster preparedness ($p = 0.001$) than nurses who had no disaster response experience (M = 3.34) and no training on disaster management (M = 3.45) (Table A1 in the Appendix).

3.5. Correlation and multiple linear regression among disaster knowledge, skills and preparedness of nurses in Dhaka City

Significant positive relationships were found between nurses' disaster knowledge and their disaster skills ($r = 0.725$, $p < 0.01$) and between nurses' disaster knowledge and disaster preparedness ($r = 0.595$, $p < 0.01$). Moreover, a moderate positive significant relationship was also found between nurses' disaster skills and disaster preparedness ($r = 0.640$, $p < 0.01$) (Table 6).

Using multiple linear regression analyses, it was seen that the disaster knowledge, skills, and preparedness scores were significantly associated with the disaster response experience ($P < 0.001$) and training on disaster management ($P < 0.001$) (Table 7). Moreover, the disaster knowledge scores were also significantly influenced by respondents' non-nursing academic degrees ($P < 0.05$) and the types of the hospital they were working in ($P < 0.01$). Besides, the scores of disaster skills were significantly associated with the respondents' nursing experience ($P < 0.05$) and their non-nursing academic degree ($P < 0.05$). Besides, hospital types ($P < 0.05$) and nurses' non-nursing degrees ($P < 0.05$) had significant influences on disaster preparedness levels (Table 7).

3.6. Open-ended questions

An open-ended question was asked to the respondents to know what steps should be taken to increase the disaster management capacity of the nurses in Dhaka city. Almost half of the responses (49.4%) were about carrying out emergency drills for both disaster preparedness and disaster response in hospitals. Arranging more training on disaster management and emergency nursing was orated by 43.1% of the nurse respondents, and one-fourth of respondents separately recommended organizing more workshops on disaster management (Fig. 1).

4. Discussion

This is the first known study that focuses on the disaster preparedness of nurses in Dhaka City. In this study, we assessed the perceived knowledge, skills, and preparedness for disaster management and examined the factors associated with the perceived knowledge, skills, and preparedness levels. In general, the results showed that nurses had moderate to low levels of knowledge, skills, and preparedness for disaster management. This finding also consistent with the findings of Al Khalaileh et al. (2012) and Usher et al. (2015a), who also found that low-to-moderate levels of disaster preparedness among the nurses of Jordan and Asia–Pacific region, respectively. The findings indicate that nurses of megacity 'Dhaka' were not adequately prepared for disaster management. Therefore, the Megapolis nurses need to develop further to gain effective disaster management abilities.

In the knowledge section, we found that the top-ranked answer respondents gave "I would be interested in educational classes on disaster preparedness that relate specifically to my community situation." In contrast, the low-ranked answers were "I find that the research

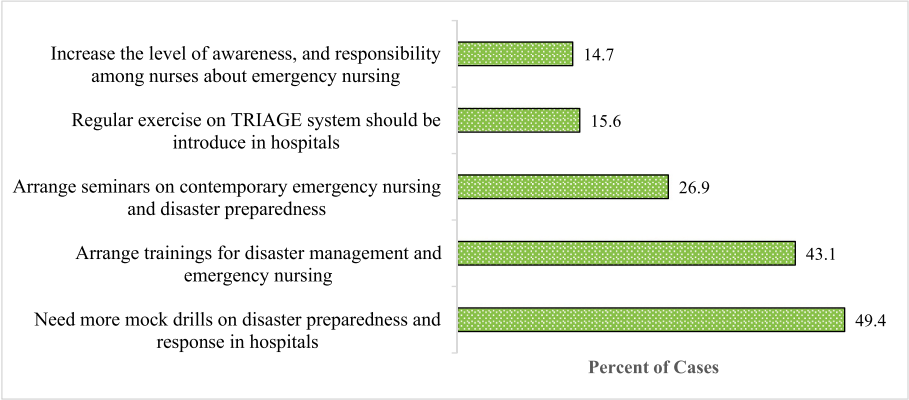

Fig. 1. Top recommendations from Dhaka city nurses to improve their disaster management capacity ($n = 410$).

published work on disaster preparedness and management is easily accessible" and "I participate in one of the following educational activities regularly: continuing education classes, seminars, or conferences dealing with disaster preparedness." These findings indicate that nurses were aware of disaster education's importance through disaster education opportunities such as limited access to journals, research works, and other reading materials are relatively low, especially in the Least developed countries (LCDs) and Developing countries (Al Khalaileh et al., 2012), which might significantly affect disaster knowledge and preparedness (Sangkala and Gerdtz, 2018). Only one-fifth of the nurses reported that they have the training, exercises, or drill experience in disaster management. A similar finding was stated by Al Khalaileh et al. (2012), who studied Jordanian nurses' disaster knowledge using the same DPET tool. Moreover, drills, evacuation and rescue exercises, simulations, and other hands-on training also increase nurses' knowledge and education on disaster management, which should be arranged regularly (Ahayalimudin and Osman, 2016; Xu and Zeng, 2016).

We found that nurses have limited participation in drafting and planning the emergency plan for their community. However, in contrast, Rogers and Lawhorn (2007) found that nurses played a crucial role in planning disaster management and firmly recommended that nurses need to incorporate in disaster management plan drafting and community disaster planning. Nurses' limited participation in developing disaster management plans in many countries due to unequal chances for females in the society and decision-making activities as most nurses are female and have limited professional recognition. Limited involvement in the development of disaster management plans may also affect the plan's implementation because if nurses did not fully understand the plan, it subsequently caused ineffective delivery in healthcare to disaster victims (Powers and Daily, 2010). Moreover, we also found that participation in disaster management-related training was significantly positively associated with higher levels of disaster knowledge, indicating that disaster management training plays a significant role in increasing nurses' disaster management knowledge and education as well as response capacity (Husna et al., 2011). Several previous studies also support this claim (Chapman and Arbon, 2008; Duong, 2009). Thus, it is vital to regularly organize various training, seminars, and symposiums on disaster management for all nurses.

In the skills section, we found that nurses rated their disaster management skills slightly higher than their disaster management knowledge, but the scores were still not up to the marks. This result is similar to the findings of Usher et al. (2015a) and Fothergill et al. (2005), where they found a lack of skills and training for effective disaster management. Moreover, the respondents had limited participation in creating new guidelines and emergency plans, as well as had limited skills for performing isolation procedures and executing decontamination procedures in case of biological attacks or bioterrorism. These findings are congruent with Tichy et al. (2009), who found that most nurses need more skills and information about biological and chemical agents. The study on emergency department nurses in New South Wales, Australia, also showed that respondents are not adequately skilled in dealing with biological agents (Brewer et al., 2020). Thus, emphasis should be given to incorporate biological agent management in nursing education or curricula, as suggested by Steed et al. (2004).

Regular participation in various drills on disaster evaluation and management enhances nurses' skills and understanding of their roles in disaster situations (Hammad et al., 2011). However, we found that Dhaka city nurses infrequently participated in the disaster dills in their workplace. Thus, drills should be arranged regularly for all nurses, and their participation should also be ensured in those drills to develop the necessary skills to respond competently and confidently when disasters strike. Moreover, disaster management training and previous disaster response experience were significantly positively associated with the nurses' higher disaster skills. Usher et al. (2015a) also found similar findings in studying the registered nurses' disaster preparedness in Asia–Pacific region. Since large-scale disasters are mostly unpredictable, nurses and other health care responders should be adequately skilled to provide sufficient care to the victims.

The last part of the questionnaire was related to nurses' post-disaster management preparedness. In the study, we found that Dhaka city nurses were moderately prepared to deal with the post-disaster situation, especially managing PTSD patients and health assessments with treatments of victims of bio-agents. Usher et al. (2015a), Öztekin et al. (2016), and Al Thobaity et al. (2015) also found similar findings on nurses' post-disaster preparedness. However, Tzeng et al. (2016) found relatively higher disaster preparedness of Taiwanese military hospital nurses who followed strict disaster management protocols with several training opportunities on disaster management and usually have more competencies related to disasters and emergencies than the nurses working in general hospitals. Besides, we found that nurses' disaster preparedness was significantly positively correlated to disaster training and previous response experience, which indicates that adequate training and education are the cornerstones of nurses' effective disaster preparedness. Moreover, nurses' readiness to disaster is also associated with disaster-related training (Tzeng et al., 2016).

Our results provided compelling evidence for long-term planning and investment for nursing education and capacity enhancing programs so that nurses in Dhaka city would be able to deal with disaster effectivity and adequately in the future. However, some limitations of the study are worth noting. This study reflects only the current condition based on the nurses' perceived preparedness because it uses a cross-sectional study design and cannot determine the cause and effect that influence disaster preparedness. A mixed-methods approach might be used in the future to explore the deeper insights of nurses' disaster preparedness and readiness in actual settings.

5. Conclusion

Nurses are essential frontline health care staff in disaster response. Despite some limitations, the research provides valuable evidence that Dhaka city nurses are not well prepared for disaster management, which would have significant policy implications. The study findings will also help to develop time-worthy plans and programs for nurses' disaster education and training to increase their capacity to respond effectively and confidently in disaster situations. Moreover, Dhaka city nurses require regular exercises, drills, and hands-on training to increase their knowledge, skills, and disaster-management preparedness. It includes access to disaster management-related literature and field experiences so that nurses can clearly define their roles and responsibilities during disasters and gain enough confidence to operate independently in disaster situations. Moreover, further research should focus on nurses' barriers and challenges in disaster preparedness and readiness. Besides, action researches are needed to improve Dhaka city nurses' knowledge, skills, and preparedness for disaster management.

CRediT authorship contribution statement

Md. Khalid Hasan: Conceptualization, Methodology, Investigation, Formal Analysis, Writing – Original Draft, Writing – Review & Editing, Project Administration, Funding acquisition. **Tahmina Bintay Younos**: Conceptualization, Methodology, Formal Analysis, Writing – Original Draft, Writing – Review & Editing. **Zawad Ibn Farid**: Methodology, Writing – Original Draft.

Declaration of competing interest

We have no known conflict of interest to disclose.

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Appendix A

Table A1
Independent sample t-test differences in Dhaka city nurses' disaster management knowledge, skills, and preparedness according to their socio-demographic characteristics.

	F	Mean	SD	df	Calculated t	*p*
Disaster knowledge						
Gender (Male, Female)	0.590	2.92, 3.06 (M, F)	0.75, 0.65 (M, F)	408	−0.961	0.337
Marital status (Single, Married)	1.734	3.05, 3.05 (S, M)	0.62, 0.67 (S, M)	408	−0.039	0.969
Having Child (No, Yes)	0.325	3.01, 3.08 (N, Y)	0.65, 0.66 (N, Y)	408	−0.930	0.353
Types of Hospital (Public, Private)	5.333	3.01, 3.27 (Pu, Pr)	0.67, 0.53 (Pu, Pr)	408	−3.532	0.003**
Response Experience (No, Yes)	0.491	2.67, 3.61 (N, Y)	0.50, 0.54 (N, Y)	408	−15.839	0.001***
Training on Disaster Management (No, Yes)	7.443	2.85, 3.75 (N, Y)	0.55, 0.47 (N, Y)	173.34	−15.787	0.001***
Nursing Academic Degree (BSc, Associated)	0.003	3.11, 2.99 (B, A)	0.65, 0.65 (B, A)	408	1.806	0.072
Disaster skills						
Gender (Male, Female)	0.242	2.93, 3.11 (M, F)	0.80, 0.70 (M, F)	408	−1.154	0.249
Marital status (Single, Married)	0.386	3.09, 3.11 (S, M)	0.72, 0.71 (S, M)	408	−0.335	0.738
Having Child (No, Yes)	0.025	3.07, 3.14 (N, Y)	0.73, 0.70 (N, Y)	408	−0.986	0.035*
Types of Hospital (Public, Private)	0.078	3.10, 3.14 (Pu, Pr)	0.72, 0.66 (Pu, Pr)	408	−0.464	0.643
Response Experience (No, Yes)	1.927	2.78, 3.71 (N, Y)	0.56, 0.55 (N, Y)	408	−16.230	0.001***
Training on Disaster Management (No, Yes)	9.866	2.88, 3.88 (N, Y)	0.60, 0.48 (N, Y)	182.62	−16.632	0.001***
Nursing Academic Degree (BSc, Associated)	1.634	3.14, 3.08 (B, A)	(0.76, 0.66) (B, A)	408	0.910	0.363
Disaster preparedness						
Gender (Male, Female)	0.008	3.46, 3.58 (M, F)	0.54, 0.54 (M, F)	408	−0.928	0.354
Marital status (Single, Married)	0.168	3.49, 3.61 (S, M)	0.52, 0.54 (S, M)	408	−2.022	0.044*
Having Child (No, Yes)	0.035	3.83, 3.63 (N, Y)	0.52, 0.55 (N, Y)	408	−2.376	0.018*
Types of Hospital (Public, Private)	0.001	3.59, 3.49 (Pu, Pr)	0.54, 0.51 (Pu, Pr)	408	1.395	0.010**
Response Experience (No, Yes)	3.816	3.39, 3.92 (N, Y)	0.50, 0.43 (N, Y)	408	−10.624	0.001***
Training on Disaster Management (No, Yes)	0.685	3.45, 3.99 (N, Y)	0.50, 0.47 (N, Y)	408	−9.367	0.001***
Nursing Academic Degree (BSc, Associated)	1.334	3.59, 3.08 (B, A)	0.55, 0.53 (B, A)	408	0.728	0.467

df-degree of freedom; SD-standard deviation.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

Table A2
One-way ANOVA differences in Dhaka city nurses' knowledge, skills, and preparedness for disasters according to their socio-demographic characteristics.

Attributes	Perceived knowledge			Perceived skills			Perceived preparedness		
	Mean (SD)	F statistics	*p*-Values	Mean (SD)	F statistics	*p*-Values	Mean (SD)	F statistics	*p*-Values
Age (years)		3.654	0.013*		4.804	0.003**		3.508	0.015*
18 to 20	2.96 (0.84)			2.97 (0.90)			3.39 (0.44)		
21 to 30	3.00 (0.61)			3.03 (0.70)			3.53 (0.53)		
31 to 40	3.04 (0.64)			3.13 (0.59)			3.61 (0.52)		
≥41	3.31 (0.72)			3.41 (0.82)			3.74 (0.60)		
General academic qualification		3.353	0.036*		2.332	0.098		5.702	0.004**
Grade X	2.98 (0.75)			3.03 (0.75)			3.54 (0.67)		
Grade XII	3.06 (0.61)			3.11 (0.69)			3.56 (0.49)		
Honors	3.52 (0.84)			3.52 (0.86)			4.10 (0.68)		
Nursing experience (years)		2.152	0.118		7.262	0.001***		4.69	0.01**
≤5	3.03 (0.63)			3.03 (0.75)			3.49 (0.51)		
6-10	2.99 (0.63)			3.02 (0.62)			3.59 (0.49)		
≥11	3.16 (0.71)			3.32 (0.69)			3.68 (0.61)		
Type of nurses		1.851	0.158		2.62	0.074		3.129	0.045*
Register Nurse	3.06 (0.66)			3.12 (0.69)			3.61 (0.55)		
Non-register Nurse	2.96 (0.62)			2.97 (0.71)			3.45 (0.43)		
Intern-student Nurse	3.19 (0.66)			3.25 (0.82)			3.56 (0.62)		

SD-standard deviation.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

References

Ahayalimudin, N., Osman, N.N.S., 2016. Disaster management: emergency nursing and medical personnel's knowledge, attitude and practices of the East Coast region hospitals of Malaysia. Australas. Emerg. Nurs. J. 19, 203–209. https://doi.org/10.1016/j.aenj.2016.08.001.

Al Khalaileh, M.A., Bond, E., Alasad, J.A., 2012. Jordanian nurses' perceptions of their preparedness for disaster management. Int. Emerg. Nurs. 20, 14–23. https://doi.org/10.1016/j.ienj.2011.01.001.

Al Thobaity, A., Plummer, V., Innes, K., Copnell, B., 2015. Perceptions of knowledge of disaster management among military and civilian nurses in Saudi Arabia. Australas. Emerg. Nurs. J. 18, 156–164. https://doi.org/10.1016/j.aenj.2015.03.001.

Badakhsh, R., Harville, E., Banerjee, B., 2010. The childbearing experience during a natural disaster. J. Obstet. Gynecol. Neonatal Nurs. 39, 489–497. https://doi.org/10.1111/j.1552-6909.2010.01160.x.

Brewer, C.A., Hutton, A., Hammad, K.S., Geale, S.K., 2020. A feasibility study on disaster preparedness in regional and rural emergency departments in new South Wales: nurses self-assessment of knowledge, skills and preparation for disaster management. Australas. Emerg. Care 23, 29–36. https://doi.org/10.1016/j.auec.2019.12.005.

Chapman, K., Arbon, P., 2008. Are nurses ready?: Disaster preparedness in the acute setting. Australas. Emerg. Nurs. J. 11, 135–144. https://doi.org/10.1016/j.aenj.2008.04.002.

Chowdhury, Md.A., Hasan, Md.K., Hasan, Md.R., Younos, T.B., 2020. Climate change impacts and adaptations on health of internally displaced people (IDP): an exploratory study on coastal areas of Bangladesh. Heliyon 6, e05018. https://doi.org/10.1016/j.heliyon.2020.e05018.

Collander, B., Green, B., Millo, Y., Shamloo, C., Donnellan, J., DeAtley, C., 2008. Development of an "All-hazards" hospital disaster preparedness training course utilizing multi-modality teaching. Prehosp. Disaster Med. 23, 63–67. https://doi.org/10.1017/S1049023X00005598.

Cox, W., 2020. Demographia world urban areas, 2020: Tokyo lead diminishing [WWW document]. URL. https://www.newgeography.com/content/006693-demographia-world-urban-areas-2020-tokyo-lead-diminishing (accessed 7.4.21).

Cushman, J.T., Shah, M.N., Abir, M., 2019. Emergency health services in disasters and public health emergencies. In: Disaster Nursing and Emergency Preparedness for Chemical, Biological, and Radiological Terrorism, and Other Hazards. Springer Publishing Company, NY. https://doi.org/10.1891/9780826144225.0004.

Duong, K., 2009. Disaster education and training of emergency nurses in South Australia. Australas. Emerg. Nurs. J. 12, 86–92. https://doi.org/10.1016/j.aenj.2009.05.001.

Fothergill, A., Palumbo, M.V., Rambur, B., Reinier, K., McIntosh, B., 2005. The volunteer potential of inactive nurses for disaster preparedness. Public Health Nurs. 22, 414–421. https://doi.org/10.1111/j.0737-1209.2005.220506.x.

Fung, O.W.M., Loke, A.Y., Lai, C.K.Y., 2008. Disaster preparedness among Hong Kong nurses. J. Adv. Nurs. 62, 698–703. https://doi.org/10.1111/j.1365-2648.2008.04655.x.

George, D., Malley, P., 2019. IBM SPSS Statistics 25 Step by Step: A Simple Guide and Reference, 15th ed. Routledge, NY.

Hammad, K.S., Arbon, P., Gebbie, K.M., 2011. Emergency nurses and disaster response: an exploration of south australian emergency nurses' knowledge and perceptions of their roles in disaster response. Australas. Emerg. Nurs. J. 14, 87–94. https://doi.org/10.1016/j.aenj.2010.10.002.

Haque, S., Amin, S.B., Karim, S.R., 2018. Disaster risk and impact of urbanization of megacities in Bangladesh: evidence from Dhaka and Chittagong. J. Account. Finance Econ. 8, 35–57.

Husna, C., Hatthakit, U., Chaowalit, A., 2011. Emergency training, education and perceived clinical skills for tsunami care among nurses in Banda Aceh, Indonesia. Nurse Media J. Nurs. 1, 75–86. https://doi.org/10.14710/nmjn.v1i1.748.

ILO, 2017. The Rana Plaza Accident and its aftermath [WWW Document]. URL. http://www.ilo.org/global/topics/geip/WCMS_614394/lang–en/index.htm (accessed 2.24.21).

Jahan, M., 2012. Impact of rural urban migration on physical and social environment: the case of Dhaka City. Int. J. Dev. Sustain. 1, 186–194.

Jennings-Sanders, A., 2004. Teaching disaster nursing by utilizing the Jennings disaster nursing management model. Nurse Educ. Pract. 4, 69–76. https://doi.org/10.1016/S1471-5953(03)00007-6.

Jiang, L., He, H.-G., Zhou, W.-G., Shi, S.-H., Yin, T.-T., Kong, Y., 2015. Knowledge, attitudes and competence in nursing practice of typhoon disaster relief work among chinese nurses: a questionnaire survey. Int. J. Nurs. Pract. 21, 60–69. https://doi.org/10.1111/ijn.12214.

Kabir, Md.H., Sato, M., Habbiba, U., Yousuf, T.B.Y., 2018. Assessment of urban disaster resilience in Dhaka North City Corporation (DNCC), Bangladesh. Procedia Eng. 212, 1107–1114. https://doi.org/10.1016/j.proeng.2018.01.143.

Kaplan, B.G., Connor, A., Ferranti, E.P., Holmes, L., Spencer, L., 2012. Use of an emergency preparedness disaster simulation with undergraduate nursing students. Public Health Nurs. 29, 44–51. https://doi.org/10.1111/j.1525-1446.2011.00960.x.

Khankeh, H.R., Mohammadi, R., Ahmadi, F., 2007. Health Care Services at time of natural disasters: a qualitative study. Iran J. Nurs. 20, 85–96.

Labrague, L.J., Hammad, K., Gloe, D.S., McEnroe-Petitte, D.M., Fronda, D.C., Obeidat, A. A., Leocadio, M.C., Cayaban, A.R., Mirafuentes, E.C., 2018. Disaster preparedness among nurses: a systematic review of literature. Int. Nurs. Rev. 65, 41–53. https://doi.org/10.1111/inr.12369.

Martono, M., Satino, S., Nursalam, N., Efendi, F., Bushy, A., 2019. Indonesian nurses' perception of disaster management preparedness. Chin. J. Traumatol. 22, 41–46. https://doi.org/10.1016/j.cjtee.2018.09.002.

MoEF, G., 2009. Bangladesh Climate Change Strategy and Action Plan (BCCSAP) 2009. Ministry of Environment and Forests, Government of the People's Republic of Bangladesh, Dhaka, Bangladesh.

Molla, M.A.-M., 2019. Nimtoli to Chawkbazar. Dly. Star.

Nagesh, A., 2016. Huge blaze at Nestle packaging factory in Bangladesh kills at least 26. Metro. https://metro.co.uk/2016/09/11/huge-blaze-at-nestle-packaging-factory-in-bangladesh-kills-at-least-26-6121256/. (Accessed 24 February 2021).

Nasrabadi, A.N., Naji, H., Mirzabeigi, G., Dadbakhs, M., 2007. Earthquake relief: iranian nurses' responses in bam, 2003, and lessons learned. Int. Nurs. Rev. 54, 13–18. https://doi.org/10.1111/j.1466-7657.2007.00495.x.

Öztekin, S.D., Larson, E.E., Akahoshi, M., Öztekin, İ., 2016. Japanese nurses' perception of their preparedness for disasters: Quantitative survey research on one prefecture in Japan. Jpn. J. Nurs. Sci. 13, 391–401. https://doi.org/10.1111/jjns.12121.

Pourvakhshoori, S., Khankeh, H.R., Mohammadi, F., 2017. Emergency and disaster preparedness in nurses: a concept analysis. J. Holist. Nurs. Midwifery 27, 35–43. https://doi.org/10.18869/acadpub.hnmj.27.1.35.

Powers, R., Daily, E.K., 2010. International Disaster Nursing. Cambridge University Press, Cambridge.

Putra, A., Petpichetchian, W., Maneewat, K., 2011. Perceived ability to practice in disaster management among public health nurses in Aceh, Indonesia. Nurse Media J. Nurs. 1, 169–186. https://doi.org/10.14710/nmjn.v1i2.971.

Pym, A., 2009. Exploring Translation Theories. Routledge.

Rizqillah, A.F., Suna, J., 2018. Indonesian emergency nurses' preparedness to respond to disaster: a descriptive survey. Australas. Emerg. Care 21, 64–68. https://doi.org/10.1016/j.auec.2018.04.001.

Rogers, B., Lawhorn, E., 2007. Disaster preparedness: occupational and environmental health professionals' response to hurricanes Katrina and Rita. AAOHN J. 55, 197–207. https://doi.org/10.1177/216507990705500506.

Saha, R., 2018. Urban Resilience for Emergency Response in Dhaka City (SSRN Scholarly Paper No. ID 3133171). Social Science Research Network, Rochester, NY. https://doi.org/10.2139/ssrn.3133171.

Sangkala, Moh.S., Gerdtz, M.F., 2018. Disaster preparedness and learning needs among community health nurse coordinators in South Sulawesi Indonesia. Australas. Emerg. Care 21, 23–30. https://doi.org/10.1016/j.auec.2017.11.002.

Slepski, L.A., 2007. Emergency preparedness and professional competency among health care providers during hurricanes Katrina and Rita: pilot study results. Disaster Manag. Response 5, 99–110. https://doi.org/10.1016/j.dmr.2007.08.001.

Steed, C.J., Howe, L.A., Pruitt, R.H., Sherrill, W.W., 2004. Integrating bioterrorism education into nursing school curricula. J. Nurs. Educ. 43, 362–367.

Subrina, S., Chowdhury, F.K., 2018. Urban dynamics: an undervalued issue for water logging disaster risk management in case of Dhaka city, Bangladesh. Procedia Eng. 212, 801–808. https://doi.org/10.1016/j.proeng.2018.01.103.

Tichy, M., Bond, A.E., Beckstrand, R.L., Heise, B., 2009. Nurse practitioners' perceptions of disaster preparedness education. Am. J. Nurse Pract. 13, 10–22.

Trangenstein, P., Weiner, E., Irwin, M., Gordon, J., 2005. Emergency preparedness curricula nursing schools in the United States. Prehosp. Disaster Med. 20, 36–37. https://doi.org/10.1017/S1049023X0001267X.

Tribune, Dhaka, 2019. 16,000 fire incidents in 10 years. Dhaka Trib. https://www.dhakatribune.com/bangladesh/dhaka/2019/03/28/16-000-fire-incidents-in-10-years. (Accessed 24 February 2021).

Tzeng, W.-C., Feng, H.-P., Cheng, W.-T., Lin, C.-H., Chiang, L.-C., Pai, L., Lee, C.-L., 2016. Readiness of hospital nurses for disaster responses in Taiwan: a cross-sectional study. Nurse Educ. Today 47, 37–42. https://doi.org/10.1016/j.nedt.2016.02.025.

Usher, K., Mayner, L., 2011. Disaster nursing: a descriptive survey of australian undergraduate nursing curricula. Australas. Emerg. Nurs. J. 14, 75–80. https://doi.org/10.1016/j.aenj.2011.02.005.

Usher, K., Mills, J., West, C., Casella, E., Dorji, P., Guo, A., Koy, V., Pego, G., Phanpaseuth, S., Phouthavong, O., Sayami, J., Lak, M.S., Sio, A., Ullah, M.M., Sheng, Y., Zang, Y., Buettner, P., Woods, C., 2015a. Cross-sectional survey of the disaster preparedness of nurses across the Asia-Pacific region. Nurs. Health Sci. 17, 434–443. https://doi.org/10.1111/nhs.12211.

Usher, K., Redman-MacLaren, M.L., Mills, J., West, C., Casella, E., Hapsari, E.D., Bonita, S., Rosaldo, R., Liswar, A.K., Zang (Amy), Y., 2015b. Strengthening and preparing: enhancing nursing research for disaster management. Nurse Educ. Pract. 15, 68–74. https://doi.org/10.1016/j.nepr.2014.03.006.

WMA, 2018. WMA - The World Medical Association-WMA declaration of Helsinki – ethical principles for medical research involving human subjects. URL. https://www.wma.net/policies-post/wma-declaration-of-helsinki-ethical-principles-for-medical-research-involving-human-subjects/ (accessed 3.26.20).

Xu, Y., Zeng, X., 2016. Necessity for disaster-related nursing competency training of emergency nurses in China. Int. J. Nurs. Sci. 3, 198–201. https://doi.org/10.1016/j.ijnss.2016.04.009.

Yamamoto, A., 2013. Development of disaster nursing in Japan, and trends of disaster nursing in the world. Jpn. J. Nurs. Sci. 10, 162–169. https://doi.org/10.1111/jjns.12042.

Yang, Y.-N., Xiao, L.D., Cheng, H.-Y., Zhu, J.-C., Arbon, P., 2010. Chinese nurses' experience in the wenchuan earthquake relief. Int. Nurs. Rev. 57, 217–223. https://doi.org/10.1111/j.1466-7657.2009.00795.x.

Younos, T.B., Hasan, M.K., Nasreen, M., 2021. Are nurses ready? Bangladeshi nurses' perceived preparedness for disasters: a mixed-methods approach. Int. J. Disaster Risk Reduct. 58, 102195 https://doi.org/10.1016/j.ijdrr.2021.102195.