Level of Preparedness towards Flood Disaster among Emergency Healthcare Workers In Malaysia

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ABSTRAK

Banjir di Malaysia memberi kesan kepada 22% daripada populasi dan melibatkan kawasan seluas 29,800 km². Perubatan bencana memainkan peranan penting dalam menghadapi bencana banjir dan secara langsung melibatkan petugas kesihatan sektor kecemasan. Pelan kesiapsiagaan perlu melibatkan petugas kesihatan kecemasan dan kakitangan pentadbiran. Kajian ini menilai tahap pengetahuan, sikap dan amalan petugas kesihatan kecemasan terhadap kesiapsiagaan dalam menghadapi bencana banjir di Malaysia. Kajian pemerhatian hirisan lintang ini dijalankan dari Januari sehingga Disember 2023 dengan menggunakan soal selidik FloodDMQ-BM 2.0 yang telah disahkan untuk menilai tahap kesiapsiagaan petugas kesihatan kecemasan di 25 hospital kerajaan tertiari. Kumpulan sasaran terdiri daripada petugas kesihatan kecemasan yang memberikan persetujuan untuk turut serta dalam kajian ini. Daripada 496 peserta, seramai 434 telah diterima dalam kajian. Pembahagian sampel hampir seimbang dari segi jantina (50.5% lelaki, 49.5% wanita). Kebanyakan peserta mempunyai tahap pengetahuan yang rendah (73%), sikap yang sederhana (63.1%) dan amalan yang rendah (66.6%) terhadap kesiapsiagaan menghadapi banjir. Analisis multivariat mendapati pengetahuan dipengaruhi oleh faktor umur dan negeri tempat tinggal; sikap dipengaruhi oleh faktor umur; manakala amalan dipengaruhi oleh faktor jantina, pengalaman serta penglibatan dalam latihan simulasi. Terdapat korelasi yang positif antara tahap pengetahuan, sikap dan amalan. Petugas kesihatan kecemasan di Malaysia menunjukkan kesiapsiagaan yang tidak memuaskan terhadap bencana banjir, dengan tahap pengetahuan yang rendah, sikap yang sederhana dan amalan yang rendah. Faktor-faktor yang mempengaruhi tahap kesiapsiagaan termasuk umur, jantina, negeri dan pengalaman. Latihan yang bersasar perlu dilaksanakan bagi meningkatkan keupayaan tindak balas petugas kesihatan semasa menghadapi bencana banjir.

Kata kunci: *Bencana; kecemasan; petugas kesihatan*

ABSTRACT

Floods in Malaysia affect 22% of the population and 29,800 km² of land. Disaster medicine is vital for flood response and directly involves emergency healthcare workers. Preparedness plans should involve both emergency medicine residents and administrative staffs. This study evaluated emergency

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healthcare workers' knowledge, attitude and practice (KAP) regarding flood disaster preparedness in Malaysia. This observational cross-sectional study, conducted from January to December 2023, used the validated FloodDMQ-BM 2.0 questionnaire to assess the preparedness of emergency healthcare workers in 25 tertiary government hospitals. The target group were consenting emergency healthcare workers. Of the 496 participants, 434 were included. The sample was nearly balanced (50.5% male, 49.5% female). Most participants had poor knowledge (73%), moderate attitude (63.1%) and poor practice (66.6%) regarding flood preparedness. Multivariate analysis revealed that knowledge was influenced by age and residing state; attitude by age; and practice by gender, experience and involvement in drills. Positive correlations were found between KAP levels. Emergency healthcare workers in Malaysia show inadequate preparedness for flood disasters, with poor knowledge, moderate attitude and poor practice. Factors influencing preparedness include age, gender, residing state and experience. Tailored training is needed to improve healthcare workers' response capabilities during floods.

Keywords: Disaster; emergency; healthcare workers

INTRODUCTION

Malaysia faces severe annual flood disasters, affecting 22% of the population (4.82 million people) and 9% of the land (29,800 km^2). With 189 river basins, 85 of which are prone to flooding, Malaysia is especially vulnerable. States like Pahang, Kelantan and Terengganu are regularly impacted due to their proximity to the South China Sea and heavy rainfall during the monsoon season (Mafauzy et al. 2021).

The disaster management cycle includes mitigation, preparedness, response and recovery (National Disaster Management Agency 2024). Mitigation occurs before a disaster and involves strategies like engineering, property arrangement and land management. Preparedness also takes place before a disaster, including education, training, drills and exercises. After a disaster, responses like safety measures, disaster plans, cleanup and resource distribution are necessary to protect people and property. The recovery phase follows, involving resource acquisition, rebuilding and forming partnerships (AkitaBox 2023).

Disaster medicine is a speciality for medical doctors, with emergency physicians often take key roles in the response. Flood disaster preparedness should be a priority for both emergency medicine residents and administrative staffs (Baharuddin et al. 2015). Proper training in flood disaster preparedness is essential for healthcare workers

(HCWs), as they are crucial in managing flood victims.

Preparedness assessments should begin with Emergency Department (ED) personnel, as the ED is central to disaster response. It serves as the first stage of the hospital's response to disasters of any scale (Australasian College for Emergency Medicine 2020). The ED must have policies and procedures to ensure established disaster systems, trained staff, adequate supplies and safe spaces for managing disasters like floods. Emergency HCWs, as frontliners, are expected to be ready and respond swiftly during such events. Currently, there are a limited number of studies regarding the preparedness of HCWs in terms of knowledge, attitude and practice (KAP) for disasters in Malaysia.

FloodDMQ-BM 2.0© is a questionnaire developed to assess flood disaster preparedness among healthcare providers (Abdul Ghani et al. 2016). The questionnaire originally consisted of 34 items to assess the KAP of healthcare providers based on four domains, namely alert systems, communication, standard of practice and transportation. It has been used and tested for its validity and reliability by using Exploratory Factor Analysis and Item Response Theory. The questionnaire was then further validated using Confirmatory Factor Analysis and Item Response Theory (Mafauzy et al. 2021). The questionnaire was used to test the effectiveness of integrated

medical response protocol among healthcare workers in Kelantan (Mohd Fudzi et al. 2019). Prior to this study, the questionnaire has never been used for assessment at a national level.

This study aimed to evaluate the level of KAP among emergency HCWs in Malaysia for flood disasters. This is crucial as Malaysia has faced several devastating floods, and HCWs are often significantly affected. Their workload increases, and they may also become victims of the disaster.

MATERIALS AND METHODS

This is an observational cross-sectional study using a FloodDMQ-BM 2.0, which was distributed to the ED of tertiary government hospitals in Malaysia. A total of 25 hospitals representing each state were selected. Research ethics approval was obtained from Universiti Kebangsaan Malaysia Medical Research Committee (Project Code JEP-2022-711) and the Malaysian Ministry of Health Medical Research Ethics Committee (NMRR ID-22-02083-8IP (IIR)) prior to data collection. Data was collected from January 2023 to December 2023 (approximately one year). This study's population comprised of HCWs who worked in the EDs of government hospitals in Malaysia, consented to the study and fulfilled the inclusion and exclusion criteria. Emergency HCWs who were directly in the clinical management of patients (doctors, nurses, paramedics and health attendants) were invited to this study. Incomplete questionnaires were excluded.

The FloodDMQ-BM 2.0 questionnaire had 33 items and was divided into four sections i.e. demographic data, attitude, practice and knowledge. The attitude section included 13 questions rated on a 4-point scale: 1 = "disagree," 2 = "neutral," 3 = "agree," and 4 = "strongly agree," with scores ranging from 13 to 52. The practice section contained 12 questions, also rated on a 4-point scale: 1 = "never," 2 = "sometimes," 3 = "often," and 4 = "always," with scores ranging from 12 to 48. The knowledge section had 8 questions scored as "true", "false" or "don't know." One point was given for a correct answer and zero points for incorrect or "don't know" answers, with scores ranging from 0 to 8.

There was no formal figure for the number of HCWs who were working in EDs in Malaysia. Most government hospitals in Malaysia were under the Ministry of Health, with the remaining university hospitals and military hospitals. According to the formal report of Ministry Health in 2019, there were a total of 254,290 posts filled up in the ministry. A total of 125,314 posts consisted of medical officers, dentists, pharmacists, nurses and assistant medical officers. There were 65,008 posts of executors ('pelaksana') that were filled up and this number included the health attendants.

Based on the pre-calculated table by Kredjie and Morgan (1970), the minimum sample size required to achieve a statistical power of 80% at a confidence level of 95% was 384 HCWs. To avoid missing data and dropout, 20% was added to the estimated sample size. Hence, a total of 461 participants should be recruited.

This study was conducted in hospitals under the Ministry of Health and the Ministry of Higher Education. One to three hospitals from each state of Malaysia were selected for the distribution of the questionnaires. There were 25 hospitals involved (Table S1). Convenience sampling was used for data collection. The questionnaire was forwarded to each ED and distributed to the HCWs via a social media application. Additional questionnaires were also distributed to HCWs of the hospitals by scanning a quick response (QR) code that linked to the questionnaire. During this phase, the respondents were welcome to ask any question regarding the research in case of doubts, unclear or uncertainties. Before answering the questionnaire, the respondents were required to fill up the consent section to indicate their willingness to participate in this study. The respondents were free to withdraw from this study at any stage of the survey. The time taken to complete the questionnaire was approximately 10 minutes.

Descriptive statistics were employed, presenting categorical data as frequency and percentage and continuous data as median and range. Mann-Whitney test was done for

inferential analysis with continuous dependent variables and categorical independent variables with two variables only, while Kruskal Wallis test was done for inferential analysis with continuous dependent variables and categorical independent variables with more than two variables. Univariate and multivariate linear regression analyses were conducted to assess the relationship between sociodemographic factors and knowledge, attitude and practice scores. Spearman correlation coefficient was performed to investigate the correlation between knowledge, attitude and practice score.

As the Kolmogorov-Smirnov test revealed that the scores of KAP were not normally distributed, all the numerical data were presented as median; range (minimum-maximum). Mann-Whitney U test and Kruskal Wallis Test were used to compare the median score of KAP between each of the variables. Univariate logistic regression analysis

and multivariate logistic regression analysis were used to determine cofounding and independent predictors of KAP scores.

RESULTS

A total of 496 participants participated in this study. However, only 434 participants were included as 62 of the questionnaires were incomplete. There were 219 (50.5%) males and 215 (49.5%) females. The predominant demographic profile of the participants revealed a majority of Malays, primarily in the age group of 30 to 39 years. A total of 210 (48.4%) participants had a professional tenure of less than 5 years in the medical field. Among the participants, 54.4% identified as doctors, with assistant medical officers (24.4%) being the next most common group. Only 18.4% of participants had experience in temporary evacuation centres (Table 1). Most

TABLE 1: Sociodemographic of participants, n = 434

Baseline Characteristics	n (%)
Age (Years)	
18 - 29 years	169 (38.9)
30 - 39 years	203 (46.8)
40 - 49 years	57 (13.1)
50 years and above	5 (1.2)
Race	
Malay	356 (82.0)
Chinese	34 (7.8)
Indian	27 (6.2)
Bumiputera Sabah	11 (2.5)
Bumiputera Sarawak	4 (0.9)
Orang Asli	1 (0.2)
Punjabi	1 (0.2)
Gender	
Male	219 (50.5)
Female	215 (49.5)
Length of service in the health field (years)	
5 years and below	210 (48.4)
6 - 15 years	168 (38.7)
16 - 25 years	50 (11.5)
26 years and above	6 (1.4)
Occupation	
Doctor	236 (54.4)
Nurse	65 (15.0)
Assistant Medical Officer	106 (24.4)
Healthcare Assistant	27 (6.2)

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Baseline Characteristics	n (%)
State	1 (0.2)
Johor	6 (1.4)
Kedah	74 (17.1)
Kelantan	71 (16.4)
Malacca	51 (11.8)
Negeri Sembilan	42 (9.7)
Pahang	3 (0.7)
Perak	1 (0.2)
Perlis	6 (1.4)
Sabah	2 (0.4)
Sarawak	26 (6.0)
Selangor	57 (13.1)
Terengganu	94 (21.7)
Federal Territories of Kuala Lumpur	
Region	
Central	120 (27.6)
East Coast	173 (39.9)
East Malaysia	8 (1.8)
Northern	10 (2.3)
Southern	123 (28.3)
Experience in flood disaster management/ temporary evacuation centre	
No	352 (81.1)
Yes	82 (18.9)
Involvement in patients' management during flood disaster in hospital	
No	336 (77.4)
Yes	98 (22.6)
Flood victim	
No	294 (67.7)
Yes	140 (32.3)
Involvement in flood disaster drill	
No	414 (95.4)
Yes	20 (4.6)

respondents had poor knowledge and practice with moderate attitude (Figure 1).

This study identified a significant association between knowledge score with age, length of service, states, experience in flood disaster management or temporary evacuation centres and involvement in patients' management during flood disasters in hospitals (p <0.05) (Table 2). A significant association was observed between attitude score with age (p = 0.013). A significant association was found between practice score with ethnicity, gender, length of service, experience in flood disaster management or temporary evacuation centre, involvement in patients' management during flood disasters in

hospitals and involvement in flood disaster drills (p < 0.05).

Univariate analysis showed a significant association between knowledge scores with age group 40-49 years old, work experience >26 years, state of Negeri Sembilan and Kuala Lumpur, experience in flood disaster management or temporary evacuation centres and managed patients during flood disasters in hospitals (p<0.05) (Table 3). A significant association was observed between attitude scores and the age group 40-49 years old. A significant association was identified between practice scores with Malay and Chinese ethnicities, both genders, work experience < 5 years and 16-25 years, experience in flood
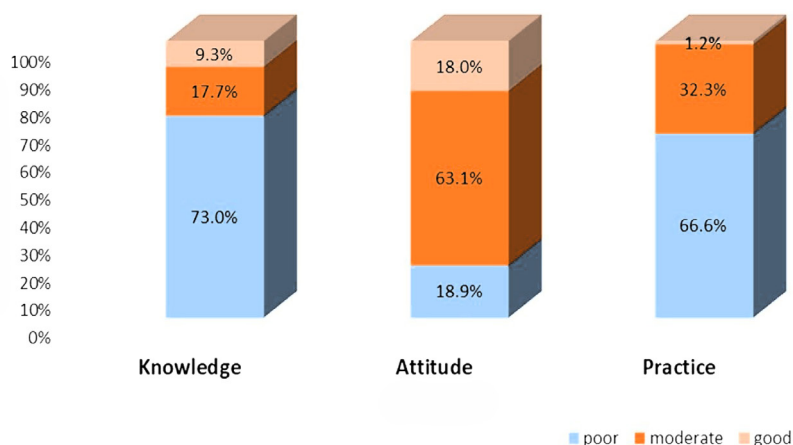
FIGURE 1: Level of knowledge, attitude, and practice (KAP) among healthcare workers regarding preparedness towards flood disaster in Malaysia (n = 434). The bar chart illustrates the distribution of participants classified as having "Good" vs. "Poor" levels of proficiency across the three domains

TABLE 2: Association between sociodemographic and knowledge, attitude and practice score

Baseline Characteristics	Knowledge Score		Attitude Score		Practice Score	
	Median; range	p-value	Median; range	p-value	Median; range	p-value
Age (Years)		0.004		0.013		0.117
18 – 29 years	3; 0 – 8		46; 26 – 52		28; 12 – 48	
30 – 39 years	3; 0 – 8		45; 27 – 52		32; 12 – 48	
40 – 49 years	4; 0 – 8		41; 29 – 52		32; 12 – 47	
50 years and above	5; 3 – 6		47; 37 - 52		29; 23 – 47	
Ethnicity		0.688		0.143		0.031*
Malay	3; 0 – 8		45; 28 – 52		32; 12 – 48	
Chinese	3; 0 – 8		49.5; 33 – 52		19.5; 12 – 46	
Indian	2; 0 – 7		44; 26 – 52		26; 12 – 47	
Bumiputera Sabah	4; 1 – 7		39; 30 – 52		34; 12 – 45	
Bumiputera Sarawak	3.5; 2 – 8		40; 26 – 42		30.5; 22 – 37	
Orang Asli	4; 4 – 4		39; 39 – 39		12; 12 – 12	
Punjabi	6; 6 – 6		44; 44 - 44		25; 25 – 25	
Gender		0.87		0.681		0.002*
Male	3; 0 – 8		46; 26 – 52		32; 12 – 48	
Female	3; 0 – 8		44; 28 - 52		28; 12 – 48	
Length of service in the healthcare field (years)		0.011		0.128		0.011*
5 years and below	3; 0 – 8		45; 26 – 52		28; 12 – 48	
6 - 15 years	3; 0 – 8		45; 26 – 52		32; 12 – 48	
16 - 25 years	4; 0 – 8		43; 29 – 52		32; 12 – 47	
26 years and above	5.5; 3 – 8		42.5; 37 – 52		34; 24 – 42	

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Baseline Characteristics	Knowledge Score		Attitude Score		Practice Score	
	Median; range	p-value	Median; range	p-value	Median; range	p-value
Occupation		0.124		0.244		0.351
Doctor	3; 0 – 8		45; 26 – 52		31; 12 – 48	
Nurse	4; 0 – 8		45; 30 – 52		33; 12 – 47	
Medical Assistant	3; 0 – 8		46; 26 – 52		31; 12 – 48	
Healthcare Assistant	4; 0 – 8		40; 29 – 52		27; 12 – 45	
State		0.023		0.054		0.287
Johor	6; 6 – 6		52; 52 – 52		40; 40 – 40	
Kedah	4; 2 – 6		39; 36 – 52		24.5; 12 – 33	
Kelantan	3; 0 – 8		43; 30 – 52		31; 12 – 47	
Malacca	4; 0 – 8		47; 28 – 52		29; 12 – 47	
Negeri Sembilan	3; 0 – 7		44; 29 – 52		23; 12 – 48	
Pahang	3; 0 – 8		42; 36 – 52		33.5; 12 – 48	
Perak	2; 1 – 2		48; 37 – 52		20; 12 – 39	
Perlis	6; 6 – 6		51; 51 – 51		42; 42 – 42	
Sabah	4; 2 – 6		44.5; 35 – 52		33.5; 15 – 42	
Sarawak	3.5; 3 – 4		46.5; 41 – 52		24.5; 12 – 37	
Selangor	4; 0 – 8		42.5; 26 – 52		33; 12 – 47	
Terengganu	3; 0 – 8		49; 37 – 52		35; 12 – 48	
Kuala Lumpur	2; 0 – 8		45; 26 – 52		28; 12 – 48	
Region		0.588		0.689		0.11
Central	3; 3 – 3		44.5; 26 – 52		30; 12 – 48	
East Coast	3; 0 – 8		45; 30 – 52		33.5; 12 – 48	
East Malaysia	4; 2 – 6		50; 35 – 52		33; 12 – 42	
Northern	3.5; 1 – 6		43; 36 – 52		26; 12 – 42	
Southern	3; 0 – 8		46; 28 – 52		27; 12 – 48	
Experience in flood disaster management/ temporary evacuation centre		0.004		0.944		<0.05*
No	3; 0 – 8		45; 26 – 52		28; 12 – 48	
Yes	3.5; 0 – 8		45; 32 – 52		35; 12 – 47	
Involvement in patients' management during flood disaster in hospital		0.017		0.994		<0.05*
No	3; 0 – 8		45; 26 – 52		28.5; 12 – 48	
Yes	3.5; 0 – 8		45; 30 – 52		35; 12 – 48	
Flood victim		0.072		0.997		0.106
No	3; 0 – 8		45; 26 – 52		30; 12 – 48	
Yes	3; 0 – 8		45; 26 – 52		32; 12 – 48	
Involvement in flood disaster drill		0.077		0.325		<0.05*
No	3; 0 – 8		45; 26 – 52		30; 12 – 48	
Yes	4; 0 – 8		49; 36 – 52		40; 26 – 47	

*significant value with p < 0.05. Mann-Whitney test was done for gender, experience in flood disaster management/ temporary evacuation centre, involvement in patients' management during flood disaster in hospital and involvement in flood disaster drill. Kruskal Wallis test was done for ethnicity and length of service in the healthcare field.

TABLE 3: Univariate analysis between participants' sociodemographic and knowledge, attitude and practice score

Baseline Characteristics	Knowledge Score		Attitude Score		Practice Score	
	Odd ratio, (95%CI)	p-value	Odd ratio, (95%CI)	p-value	Odd ratio, (95%CI)	p-value
Age (Years)						
18 – 29 years	-0.405 (-0.821, 0.012)	0.057	0.760 (-0.465, 1.984)	0.223	-	-
30 – 39 years	-0.101 (-0.510, 0.307)	0.626	0.426 (-0.770, 1.623)	0.484	-	-
40 – 49 years	0.906 (0.310, 1.503)	0.003*	-2.697 (-4.446, -0.948)	0.003*	-	-
50 years and above	1.552 (-0.350, 3.454)	0.109	1.905 (-3.686, 7.495)	0.503	-	-
Ethnicity						
Malay	-	-	-	-	4.347 (1.604, 7.090)	0.002*
Chinese	-	-	-	-	-6.318 (-10.235, -2.401)	0.002*
Indian	-	-	-	-	-2.669 (-7.070, 1.732)	0.234
Bumiputera Sabah	-	-	-	-	0.372 (-6.401, 7.146)	0.914
Bumiputera Sarawak	-	-	-	-	1.100 (-10.040, 12.241)	0.846
Orang Asli	-	-	-	-	-16.949 (-39.095, 5.197)	0.133
Punjabi	-	-	-	-	-3.919 (-26.120, 18.282)	0.729
Gender						
Male	-	-	-	-	3.379 (1.270, 5.488)	0.002
Female	-	-	-	-	-3.379 (-5.488, -1.270)	0.002
Length of service in the healthcare field (years)						
5 years and below	-0.160 (-0.567, 0.247)	0.440	-	-	-3.326 (-5.441, -1.211)	0.002
6 – 15 years	-0.228, (-0.646, 0.189)	0.283	-	-	1.418 (-0.771, 3.607)	0.204
16 – 25 years	0.629 (-0.012, 1.269)	0.054	-	-	4.273 (0.924, 7.622)	0.013*
26 years and above	2.273 (0.543, 4.002)	0.010*	-	-	4.767 (-4.363, 13.898)	0.305
State						
Johor	2.741 (-1.497, 6.978)	0.204	-	-	-	-
Kedah	0.745 (-0.997, 2.487)	0.401	-	-	-	-
Kelantan	0.478 (-0.061, 1.018)	0.082	-	-	-	-
Malacca	0.542 (-0.007, 1.090)	0.053	-	-	-	-

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Baseline Characteristics	Knowledge Score		Attitude Score		Practice Score	
	Odd ratio, (95%CI)	p-value	Odd ratio, (95%CI)	p-value	Odd ratio, (95%CI)	p-value
Negeri Sembilan	-0.657 (-1.286, -0.027)	0.041*	-	-	-	-
Pahang	0.049 (-0.640, 0.737)	0.890	-	-	-	-
Perak	-1.610 (-4.062, 0.842)	0.198	-	-	-	-
Perlis	2.741 (-1.497, 6.978)	0.204	-	-	-	-
Sabah	0.576 (-1.167, 2.318)	0.516	-	-	-	-
Sarawak	0.235 (-2.770, 3.241)	0.878	-	-	-	-
Selangor	0.822 (-0.032, 1.677)	0.059	-	-	-	-
Terengganu	-0.305 (-0.912, 0.302)	0.324	-	-	-	-
Kuala Lumpur	-0.652 (-1.142, -0.161)	0.009*	-	-	-	-
Experience in flood disaster management/ temporary evacuation centre						
Yes	0.766 (0.245, 1.286)	0.004*	-	-	7.184 (4.515, 9.853)	<0.05*
Involvement in patients' management during flood disaster in hospital						
Yes	-	-	-	-	5.282 (2.780, 7.783)	<0.05*
Involvement in flood disaster drill						
Yes	-	-	-	-	9.771 (4.893, 14.649)	<0.05*

*Significant value with p < 0.05. Multi variate analysis was performed for all baseline characteristics.

disaster management or temporary evacuation centres, managed patients during flood disasters in hospitals and participation in flood disaster drills (p < 0.05).

The multivariate analysis demonstrated a significant decrease in knowledge scores in the age group 40-49 years old and in the states of Negeri Sembilan and Kuala Lumpur (Table 4). There was a significant decrease in attitude score for the age group 40-49 years old. There was a

significant increase in practice scores for HCWs who had previous experience with managing flood disasters and previous experience in flood disaster drills. There was a significant decrease in practice scores for female participants (p < 0.05).

There was a positive correlation between knowledge and practice, with a correlation coefficient of 0.265 (p < 0.05). Similarly, there was a significantly positive correlation between attitude and practice, with a correlation

TABLE 4: Multivariate analysis between participants' sociodemographic and knowledge, attitude, and practice score

Baseline Characteristics	Knowledge Score		Attitude Score		Practice Score	
	Odd ratio, (95%CI)	p-value	Odd ratio, (95%CI)	p-value	Odd ratio, (95%CI)	p-value
Age (Years)					-	-
40 – 49 years	0.660 (0.040, 1.280)	0.037	-2.697 (-4.446, -0.948)	0.003		
Ethnicity						
Malay	-	-	-	-	1.669 (-1.714, 5.052)	0.333
Chinese	-	-	-	-	-3.492 (-8.325, 1.340)	0.156
Gender						
Male	-	-	-	-	Ref	
Female	-	-	-	-	-2.587 (-4.644, -0.529)	0.014
Length of service in the healthcare field (years)						
5 years and below	-	-	-	-	-1.556 (-3.802, 0.691)	0.174
16 – 25 years	-	-	-	-	0.895 (-2.584, 4.374)	0.614
26 years and above	1.734 (-0.012, 3.481)	0.052	-	-	-	-
State						
Negeri Sembilan	-0.715 (-1.351, -0.078)	0.028	-	-	-	-
Federal Territories of Kuala Lumpur	-0.640 (-1.140, -0.140)	0.012	-	-	-	-
Experience in flood disaster management/ temporary evacuation centre (PPS)?						
Yes	0.469 (-0.119, 1.057)	0.118	-	-	3.988 (0.951, 7.024)	0.010
Involvement in patients' management during flood disaster in hospital						
Yes	0.027 (-0.524, 0.577)	0.924	-	-	2.208 (-0.586, 5.001)	0.121
Involvement in flood disaster drill						
Yes	-	-	-	-	6.745 (1.774, 11.716)	0.008

coefficient of 0.227 (p < 0.05).

DISCUSSION

The current study's results observed a significant association between the sociodemographic factors of emergency HCWs and their level of preparedness in managing their patients during flood disasters, which was reflected in the KAP scores in the FloodDMQ-BM 2.0 questionnaire. To determine the level of KAP, the marks were converted to percentages by dividing them by possible maximum marks and categorised using modified Bloom's Cut-Off Points. A good score is 80-100%, moderate is 60-79% and poor is 59% (Bloom 1968).

The results indicated that less than 10% of participants have good knowledge. The low level of knowledge among emergency HCWs in this study may reflect a suboptimal practice level; however, most respondents demonstrated a moderate attitude towards flood disaster preparedness. These findings contrast with a previous study conducted in Saudi Arabia, where more than half of the participants had good knowledge of flood preparations and the treatment of flood victims (Al-Wathinani et al. 2021). The differences between current study and previous study might be attributed to the different questionnaires used. The current study utilised the FloodDMQ-BM 2.0, whereas the previous study used a modified, validated version of HCWs' willingness to respond to an earthquake scenario, which was adapted to a flooding scenario. Consequently, the previous study's questionnaire focused only on participants' familiarity with their hospital's flood disaster standard of practice (SOP) and their perceived knowledge adequacy, while the current study assessed participants' actual knowledge levels regarding flood preparation SOPs.

Regarding the factors affecting the level of KAP, age was found to be significantly associated with knowledge and attitude scores. Participants aged 40-49 years were likelier to have lower knowledge and attitude scores than participants from other age groups. This may indicate lower

levels of knowledge and poorer attitudes toward healthcare management during flood disasters. This finding is consistent with the findings described in previous studies. For example, a cross-sectional study investigating disaster preparedness knowledge among 472 emergency nurses, reported a significant negative relationship between disaster preparedness knowledge and age (β = -0.137; p = 0.021) (Azizpour et al. 2022). Another cross-sectional study investigating the knowledge, attitude and disaster management performance among 230 emergency nurses also reported a significant negative relationship between knowledge and age (p<0.001) (Far et al. 2020). The study recorded higher mean scores of knowledge in younger emergency nurses whose ages were under 30 years (1.83 $\pm$ 0.46) compared to other older age groups, including 30-40 years (1.56 $\pm$ 0.52) and >40 years (1.62 $\pm$ 0.46) (Far et al. 2020). Findings from these studies suggested that the knowledge of emergency HCWs in disaster preparedness has not been updated, and there are no consistent and serious studies in this aspect as they get older. HCWs are usually married and having the responsibility of caring for their families in addition to their jobs. Such circumstances will alter their attitude and make them not have the necessary time and energy to participate in disaster training courses, which can be one of the reasons for the decrease in disaster preparedness knowledge as age increases (Far et al. 2020; Azizpour et al. 2022). Although previous literature had not reported a direct and significant relationship between age and attitude toward disaster management (Shanableh et al. 2023), a significant but indirect positive relationship was observed between attitude and knowledge in an analytical descriptive study (Janizadeh et al. 2023). The study reported that as attitudes towards disaster preparedness in hospital emergency staff improved, their knowledge of disaster management also increased (ρ = 254; p < 0.001). In line with this finding, decreased attitude towards flood disaster preparedness coincided with decreased knowledge about disaster preparedness observed in older HCWs in this study.

Gender was found to be a significant factor influencing practice scores. Female emergency HCWs were shown to have a higher tendency to obtain lower practice scores compared to their male counterparts, suggesting female participants were less prepared of handling patients correctly during flood disasters. Consistent with current observation, a previous study evaluating the level of preparedness of emergency nurses in disaster management also revealed a similar relationship between gender and the mean score of performance. Female nurses had a significantly lower mean score of performance compared to male nurses (1.58 $\pm$ 1.58 vs 2.05 $\pm$ 0.49; p = 0.03), indicating poorer performance on the female side in handling patients in a disaster setting (Far et al. 2020). This is probably influenced by the difference in the level of disaster preparedness between females and males. A multicentre descriptive cross-sectional study showed that female emergency HCWs had a negative correlation with disaster preparedness (B = -9.638; t = -2.003; p = 0.046) (Zhang et al. 2023). Another study showed male emergency HCWs (aOR = 1.639; 95% CI = 1.102-2.439; p = 0.015) were more likely to express willingness to participate in natural disasters, including floods (Al-Hunaishi et al. 2019). The lower level of preparedness and poorer performance of female emergency HCWs suggested they were less likely to participate in practical disaster management courses due to their involvement in family affairs and might not have enough time to attend the courses at the hospital. Married female HCWs with a family tended to prioritise their family over attending practical courses and receiving updated training in disaster management (Far et al. 2020).

The length of service in the healthcare field was positively correlated with knowledge score, where emergency HCWs who had longer experience working in the healthcare field (≥26 years) were more knowledgeable in matters concerning patient management during flood disasters compared to those with lesser experience in the related field. However, the correlation was non-significant as it was slightly just over 0.05.

A similar though more significant correlation was also mentioned in a previous literature that investigated the knowledge, attitude and confidence level of flood disaster management among 92 emergency doctors from Terengganu, a state in Malaysia that is constantly affected by floods. The study identified the doctors' service duration and duration of working in the ED (p = 0.008) as a significant factor affecting knowledge of flood disaster management. Emergency doctors who had been working in the ED for over 10 years were found to be more knowledgeable about flood disaster management compared to novice doctors who served less than 5 years in the ED (Mustafa 2015). Similarly, another study involving 472 emergency nurses mentioned a significant relationship between disaster preparedness knowledge and years working as an emergency nurse (f = 4.174; p = 0.002) (Azizpour et al. 2022). As these findings indicated, length of service in the emergency healthcare field would improve the knowledge of emergency HCWs about flood disaster management. Working experience is the key to the clinical learning process. Years of serving in the ED help the emergency staff to be more knowledgeable and improve their intuition in patient management, which subsequently enhances their decision-making abilities during emergency disaster settings (Rizqillah & Suna 2018).

In addition, a statistically significant positive relationship was observed between emergency HCWs' experience in flood disaster management / temporary evacuation centre and their practice score. Those who had experience managing patients in flood disaster management or temporary evacuation centres before had better practical skills in real-time patient management during actual flood disasters as compared to those who previously had not worked in any flood disaster management or temporary evacuation centre. In line with current findings, a previous study also reported flood disaster response experience had a significant association with practice (Ismail 2020). According to the study investigating factors associated with knowledge, attitude, practice and perception in

flood disaster management among 250 critical care nurses working in the east coast hospitals of Malaysia, nurses who possessed flood disaster response experience were about 2.7 times (aOR = 2.697; 95% CI = 1.122-6.479; p = 0.027) more likely to show better practical skill in managing patients in a disaster setting compared to those who did not possess any flood disaster response experience (Ismail 2020). Another cross-sectional study featuring 468 ED nurses pointed out that individuals who had experience in flood disaster response were more likely to report adequate practice (aOR = 4.008; 95% CI = 1.691-9.504; p<0.01) than those who did not have related experience (Ahayalimudin et al. 2012). Similarly, a multicentre descriptive study involving 265 emergency healthcare staff revealed having experience in disaster response (B = 8.280; t = 2.111; p = 0.036) was one of the important factors which positively correlated with the level of disaster preparedness, having a subsequent positive influence on the practical skill in the staff (Zhang et al. 2023). As emphasised by these studies, disaster response experience is the basis of preparedness for disaster management. Having relevant experience in the related disaster setting helps to refine the practical skills of emergency HCWs, thus enhancing their preparedness for patient management when a disaster occurs (Zhang et al. 2023).

Emergency HCWs who were involved in flood disaster drills were more likely to have a better practice score compared to those who had not been involved in prior flood disaster drills. Involvement in flood disaster drills was noted to increase the practical skills of emergency HCWs in managing patients during flood disasters by approximately seven times, according to the regression analysis. This resonates with the findings recorded by previous studies. For instance, a study reported that attending flood disaster training/education program had a significant association with the attitude towards disaster management (aOR = 4.203; 95% CI = 2.102-8.402; p < 0.001) in critical care nurses involved in the study (Ismail et al. 2020). Nurses who had attended flood disaster training were

four times better at managing patients from the practical aspect compared to those who had not attended any flood disaster training (Ismail 2020). A study in 2019 noted there was a statistically significant difference in practice scores between emergency healthcare personnel who had flood disaster training and those who had not participated in related training (χ^2 = 34.001; p < 0.001) (Aung et al. 2019). Among the total 197 participants involved in the study, those who had flood disaster training displayed a higher mean rank than those who had not (106.29 vs 90.84) (Aung et al. 2019). Attending disaster-related training or education programs was shown to be a significant predictor for enhanced disaster management practice (aOR = 4.080; 95% CI = 2.326-7.156; p<0.001) among emergency HCWs (Ahayalimudin et al. 2012). In addition to practicality, having participated in disaster-related training was positively correlated with disaster preparedness, be it the disaster rescue simulation exercise (B = 8.929; t = 2.080; p = 0.039), disaster relief training (B = 11.515; t = 2.248; p = 0.025), or training of disaster nursing specialist nurse (B = 16.101; t = 3.125; p = 0.002), all of which could enhance the disaster preparedness among emergency nurses (Zhang et al. 2023). All these findings highlighted the importance of involvement in flood disaster drills as an effective strategy to enhance the practical skills of emergency HCWs in a stressful disaster setting.

The current study revealed a positive correlation between knowledge and attitude with practice scores, highlighting the influence of knowledge and attitude on practice readiness. This finding is consistent with previous research. For instance, a study in Saudi Arabia found a significant positive correlation between knowledge and attitude scores among nurses regarding disaster preparedness (Diab & Mabrouk 2015). Similarly, research in Indonesia emphasised the importance of good knowledge, positive attitudes and favourable behaviours in enhancing pandemic preparedness among health workers (Yanti et al. 2021). Furthermore, a study in Pakistan indicated that attitude is a significant

predictor of readiness to practice disaster medicine management among healthcare professionals (Gillani et al. 2021). These studies collectively support the idea that KAP are interconnected components that significantly impact preparedness levels among HCWs and individuals in disaster management scenarios.

As demonstrated, all three aspects of KAP had a considerable impact on the level of preparedness for flood disasters in emergency HCWs. To improve flood disaster preparedness in the staff, it is essential to provide adequate preparedness training like disaster management education programs, mock drill training and flood simulation training based on their needs. Consistency of providing periodic training can be very helpful in increasing the staff's knowledge and confidence, changing their attitude and enhancing their practical skills in flood disaster management. This is in support of the National Security Council directive no.20 for disaster response in Malaysia (National Disaster Management Agency 2024). Regular assessment using FloodDMQ-BM 2.0 will detect the trends of all KAP components for quality improvement exercises and targeted interventions.

Limitations

The results analysis relied on self-reported and perception-based questionnaire surveys. Future studies may include an objective performance matrix. The respondents involved in the present study were mostly from hospitals located around the east coast region of Malaysia, such as Kelantan, Terengganu, and Pahang, states where floods commonly occur, especially during the monsoon season. The sampling of respondents for future studies should focus on emergency HCWs from major hospitals in each state.

CONCLUSION

Despite revealing poor levels of knowledge and practice, this study found that participants demonstrated a moderate willingness and attitude to learn more about flood disaster preparedness. Factors influencing KAP included age, residing state, gender, disaster management experience and participation in drills. Knowledge and attitude were positively correlated with practice. These findings highlight the need for targeted interventions to improve disaster preparedness. Addressing KAP gaps among HCWs through education, training and policy changes can enhance flood disaster response and build a stronger disaster management framework in Malaysia.

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