

**DEVELOPMENT AND VALIDATION OF  
A QUESTIONNAIRE TO EVALUATE KNOWLEDGE,  
ATTITUDE AND PRACTICE (KAP) OF FLOOD  
DISASTER MANAGEMENT (FloodDMQ-BM)  
AMONG HEALTH CARE WORKERS IN KELANTAN**

**DR MOHD NAJIB BIN ABDUL GHANI**

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## **ABSTRAK (BAHASA MALAYSIA)**

### **PENGHASILAN DAN KESAHAN BORANG KAJI SELIDIK UNTUK MENILAI TAHAP PENGETAHUAN, SIKAP DAN AMALAN BERKENAAN PENGURUSAN BENCANA BANJIR (FloodDMQ-BM) DI KALANGAN STAFF-STAFF KESIHATAN NEGERI KELANTAN**

**Latar belakang:** Bencana banjir mempunyai kesan yang mendalam terhadap perkhidmatan perubatan di Malaysia. Walau bagaimanapun, sehingga kini tiada kaedah untuk menilai tahap pengetahuan, sikap dan amalan staff- staff kesihatan berkenaan fasa respon bencana banjir di Malaysia. Tujuan kajian ini dijalankan adalah untuk menghasilkan dan mengesahkan borang kaji selidik berbahasa Malaysia (FloodDMQ-BM) bagi menilai tahap pengetahuan, sikap dan amalan staff-staff kesihatan berkenaan pengurusan bencana banjir.

**Metodologi:** Terdapat empat domain dalam kajian borang soal selidik ini: prosedur operasi “standard”, pengangkutan, sistem amaran dan komunikasi. Analisis psikometri telah dijalankan terhadap staff-staff kesihatan yang bertugas semasa bencana banjir di Kelantan. Konsep hipotesis dinilai menggunakan “Exploratory Factor Analysis” (EFA) serta “internal consistency” untuk bahagian sikap dan amalan manakala “Item Response Theory” (IRT) untuk bahagian pengetahuan.

**Keputusan:** 36 soalan telah dihasilkan untuk FloodDMQ-BM ini. Soalan-soalan untuk bahagian sikap dan amalan mempunyai nilai “factor loading” yang baik melebihi 0.5 untuk EFA dan keutuhan yang memuaskan sebanyak 0.925 dan 0.935. Soalan-soalan dalam bahagian pengetahuan mempunyai “marginal fit” dan “Root Mean Square Error of

Approximation” yang baik iaitu 0.08. Soalan-soalan ini juga mempunyai “standardized loading” ( $>0.3$ ) dan “marginal reliability” yang sangat baik (0.623).

**Kesimpulan:** Hasil kajian menunjukkan borang kaji selidik FloodDMQ-BM ini mempunyai nilai kesahan dan psikometri kebolehpercayaan yang baik.

**Kata kunci:** banjir, bencana, borang kaji selidik, kesahan, psikometri, staff-staff kesihatan.

## **ABSTRACT**

### **DEVELOPMENT AND VALIDATION OF A QUESTIONNAIRE TO EVALUATE KNOWLEDGE, ATTITUDE AND PRACTICE (KAP) OF FLOOD DISASTER MANAGEMENT (FloodDMQ-BM) AMONG HEALTH CARE WORKERS IN KELANTAN.**

**Background:** Flood catastrophe has a major impact on healthcare service in Malaysia. However, there is no validated tool to measure the knowledge, attitude and practice of flood disaster management among healthcare workers involved in the response phase of a flood disaster in Malaysia. We aim to develop and validate a questionnaire in Bahasa Malaysia (FloodDMQ-BM) to measure the level of knowledge, attitude and practice of flood disaster management among healthcare workers.

**Materials and Methods:** The questionnaire was developed based on four domains: standard operating procedure, transportation, alert system and communication. Psychometric analyses were tested on healthcare workers involved in patient management during flood disaster in Kelantan. The hypothetical concept of the items in attitude and practice sections was assessed using Exploratory Factor Analysis (EFA) and internal consistency reliability. The knowledge section was analysed using 2-parameter logistic model of Item Response Theory.

**Result:** 36 items were generated for FloodDMQ-BM. For both the attitude and practice items, the EFA have good factor loading ( $>0.5$ ) and satisfactory internal consistency of 0.925 and 0.935 respectively. The remaining items in the knowledge section have good marginal fit and adequate Root Mean Square Error of Approximation of 0.08. All the remaining items have good standardized loading ( $>0.3$ ) and marginal reliability of 0.623.

**Conclusion:** The results suggested that the FloodDMQ-BM has valid and reliable psychometric properties.

**Keywords:** Flood, disaster, questionnaire, validate, psychometric, healthcare workers



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## DEVELOPMENT AND PSYCHOMETRIC EVALUATION OF FLOOD DISASTER MANAGEMENT QUESTIONNAIRE- (FloodDMQ-BM): EXPLORATORY FACTOR ANALYSIS AND ITEM RESPONSE THEORY ANALYSIS

Abdul Ghani M.N.<sup>1</sup>, Tuan Kamauzaman T.H.<sup>1\*</sup>, Mohd Fudzi M.F.M.<sup>1</sup>, Arifin  
W.N.<sup>2</sup>, Chew K.S.<sup>3</sup>

<sup>1</sup> Department of Emergency Medicine, School of Medical Sciences, Universiti Sains  
Malaysia, Kubang Kerian 16150 Kelantan, Malaysia

<sup>2</sup> Unit of Biostatistics and Research Methodology, School of Medical Sciences, Universiti  
Sains Malaysia, Kubang Kerian 16150 Kelantan, Malaysia

<sup>3</sup> Department of Surgery, Faculty of Medicine and Health Sciences, Universiti Malaysia  
Sarawak, Kota Samarahan, Sarawak, Malaysia

\*Corresponding author: Tuan Hairulnizam Tuan Kamauzaman, [hairulnizam@usm.my](mailto:hairulnizam@usm.my)

### ABSTRACT

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Chew K. S.*

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## 1.0 Introduction

In late December 2014, Kelantan state experienced the worst flood disaster since 1927 displacing 202,000 victims and causing widespread collapse of public infrastructure. Kelantan faces Northeast monsoon from November to March each year and compounded by unplanned urbanization, geographical characteristic and land use planning, triggered the severe flood (Baharuddin et al., 2015). Healthcare facilities were severely affected by the flood and patients had difficulties receiving medical treatment in a timely and effective manner as most of the healthcare facilities and public amenities were located on the flood plain. The main general hospital of Kelantan, Hospital Raja Perempuan Zainab II, were among the earliest hospital being malfunctioned followed by many district hospitals leaving Hospital Universiti Sains Malaysia as the only referral hospital that stood on dry ground during the whole disaster period.

Few important issues were identified in managing patient during the response phase of the flood disaster namely alert and warning systems, transportation, communication and command and control. These were the findings discovered and frequently highlighted by participants in a qualitative study among healthcare providers managing patient during flood disaster Kelantan (Tuan Kamauzaman et al., 2015). We included these components as domains in each of the knowledge, attitude and practice sections of the KAP questionnaire.

This study was aimed to develop a valid and reliable questionnaire in Bahasa Malaysia assessing the knowledge (K), attitude (A) and practice (P) among the health care providers pertaining to patient's management during flood disaster in Malaysia, known as FloodDMQ-BM. A good questionnaire can be adapted to any cultures, different places and times and yet raising similar results. A series of validation steps in this study such as face validation, content validation and construct validation is to ensure that FloodDMQ-BM is well validated before it can be applied to the target group (Streiner& Norman, 2008). Until now there is no data published on the psychometric characteristics of a KAP questionnaire measuring KAP of healthcare providers managing patients during flood disaster in Malaysia. This study provides evidence of validity and reliability of FloodDMQ-BM so that it can be utilized as an instrument to assess the KAP of healthcare providers involved in flood disaster management in Malaysia.

## 2.0 Materials and Methods

This study consisted of 2 phases, which were questionnaire development and psychometric assessment. The questionnaire development consisted of generation of questionnaire items, content validation and face validation. The psychometric assessment involves Exploratory Factor Analysis (EFA) and Item Response Theory (IRT) analysis.

Expert panels comprising of 5 consultants of Emergency Medicine who were experts in the field of disaster medical management and who were faculties of Universiti Sains Malaysia (USM), Kota Bharu, Malaysia, were tasked to develop items based on 4 issue domains (1)

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Chew K. S.*

communication (2) transportation (3) standard operating procedure (SOP) and (4) alert system. The items generation were partly based on the results of a qualitative study involving various agencies involved in patient management during flood disaster in Kelantan (Tuan Kamauzaman et al, 2015) as well as various local response guidelines of flood disaster (Baharudin et al, 2015). The questionnaire was written in Bahasa Malaysia language as it is the national language of Malaysia and well understood by all healthcare providers in Malaysia. There were 4 sections to the questionnaire (1) demographic data (2) knowledge (3) attitude and (4) practice where each section of the knowledge, attitude and practice contained items reflecting all four issue domains.

4 lecturers from Emergency Department USM and 1 lecturer from Unit of Biostatistics and Research Methodology USM formed a committee to validate the content of FloodDMQ-BM. They were selected based on their expertise in the field of disaster which is a requirement of a content validation (Harkness, 2003). The content validation was more of a qualitative judgment than that of a quantitative measurement (Crocker & Algina, 1986). They were contacted through emails and any improvement and suggestions were replied back to the investigator.

Subsequently, face validation of the FloodDMQ-BM was carried out by pretesting to verify the applicability and to evaluate user understanding of the questionnaire (Parsian & Dunning, 2009; Nevo, 1985; Shuttleworth, 2009; Guillemin, 1993). 30 respondents consisted of medical doctors working in Emergency Department Hospital Universiti Sains Malaysia (EDHUSM) were selected via convenience sampling. The sample size was considered adequate for the purpose (Perneger et al., 2014). The respondents were given adequate time to read the questionnaire before undergoing cognitive interview by the researcher. They were asked if they understand the items and if they could repeat it in their own words. Suggestions of alternative phrases used in the items were also recorded. If there were few phrases suggested to replace a word, they were asked to choose the most appropriate phrase that conforms best to their usual usage. The committee then verified these changes before any final changes made.

Construct validation was subsequently done to measure underlying hypothetical concepts of the questionnaire (Trochim & Donelli, 2008). The respondents were staffs at EDHUSM recruited by convenience sampling. The sampling method was used due to limited number of medical officers at the department and to maximize the sample size as required by the analysis. A total of 150 staffs involved in patient management during flood disaster consented to participate in the study. The sampling size met the recommended sample size of 10 subjects per item or at least 100 participants (Costello & Osborne, 2005; Hair & Anderson, 1998). They were asked to answer the questionnaire and the researcher was available at all times to clarify any phrases or terms.

Data management and statistical analysis were done using software IBM SPSS version 22.0 for validating all items in attitude and practice section via EFA and internal consistency assessed by Cronbach's alpha. EFA and internal consistency were carried out separately for all items in each attitude and practice section. Kaiser Meyer Olkin (KMO) measure of sampling adequacy with a cut-off point of  $>0.7$  (Costello & Osborne, 2005; Hair et al., 1988) and Bartlett's test of sphericity with  $p$ -value  $< 0.05$  (Hair et al., 1988; Leech et al., 2005) were



used to determine suitability of the data for EFA. Eigenvalue  $>1.0$  and visual inspection of scree plot were used to determine the number of factors. Principal axis factoring method was used to extract the factors. Cronbach's alpha coefficient value tested the internal consistency. A value of  $\geq 0.7$  is considered adequate internal consistency. The knowledge dichotomous response items were analysed by 2-parameter logistic (2PL) model of IRT using *ltm* package in R software.

### 3.0 Result

#### 3.1 Questionnaire development and content validation

A total of 36 items were generated for the questionnaire. The knowledge section, containing 12 items was scored on "true" (*betul*), "false" (*salah*) and "don't know" (*tidak tahu*) options. One point was given for a correct answer and a zero point given to an incorrect or "don't know" answer. Thus, the possible score of this section ranged from 0 to 12. The attitude part contained 12 questions and rated on 5-point Likert scale. Points were given on ascending order as following: 1="strongly disagree" (*sangat tidak setuju*), 2="disagree" (*tidak setuju*), 3="neutral" (*netral*), 4="agree" (*setuju*) and 5="strongly agree" (*sangat setuju*). The practice part contained of 12 questions and rated on a 5-point Likert scale. Points were given on ascending order as following: 1= "never" (*tidak pernah*), 2= "seldom" (*jarang*), 3= "sometimes" (*kadang-kadang*), 4= "often" (*kebanyakan masa*) and 5= "always" (*selalu*).

In this study, all of the items were acknowledged by experts, resembling the intended construct and hypotheses. No major amendment was done in all items. However, one item under domain transportation in attitude section was divided into items A2 and A3 after being reviewed by the experts. The initial item had two intended questions in a sentence, so the decision to split the item was to avoid ambiguity and misinterpretation (Streiner and Norman, 2008). Therefore, the total items in the attitude section increased from 12 items to 13 items and the total items in FloodDMQ-BM increased from 36 to 37 items

#### 3.2 Face validation

The pretesting to assess the face validation took approximately 20 to 30 minutes for each respondent. During the cognitive interview, the respondents suggested some improvement in choices of word and length of sentences, as it was too lengthy and at times too technical. The suggestions were highlighted and reviewed by experts and improvements were done accordingly. The changes include terms such as "medical assistant" (*pembantu perubatan*) into "assistant medical officer" (*penolong pegawai perubatan*) and "about" (*mengenai*) into "regarding" (*tentang*) to conform to the local usage. The items in the knowledge sections were retained even some respondents claimed that they were difficult. The experts opined that no alternative terms could be used and such terms were commonly applied in local disaster respond procedures such as, "Government Interagency Radio Network (GIRN)", "Medical Emergency Coordinating Center (MECC)" and "Amber stage" (*tahap Amaran Amber*).

3.2 Construct validation

**Table 1:** Socio-demographic characteristics of construct validation respondents (n=131)

Variables		Mean (SD)	Frequency (%)
Gender	Male		65 (49.6)
	Female		66 (50.4)
Age	20-25	32.12 (7.507)	22 (16.9)
	26-30		38 (29.2)
	31-35		44 (33.8)
	36-40		9 (6.9)
	≥41		17 (13.1)
Ethnics	Malay		114 (87.7)
	Chinese		13 (10.0)
	Indian		3 (2.3)
Place of working	University		131 (100)
	Hospital		
Working experience	≤ 5 years	8.4 (7.02)	32 (25.8)
	5-10 years		61 (49.2)
	10-15 years		14 (11.3)
	≥ 15 years		17 (13.7)
Profession	Administrator		2 (1.5)
	Doctor		57 (43.5)
	Nurse		32 (24.4)
	Medical assistant		13 (9.9)
	Support staff		17 (13.0)
	Driver		4 (3.1)
	Others		6 (4.6)

Table 1 shows the socio-demographic profile of the respondents. Out of 150 questionnaires distributed, 131 applicants responded to this study yielding an 87% response rate. In total, the missing data rate ranged from 0% to 0.07% for all sections and these data were excluded from the study. Recoding was done for the scale of the attitude section: 1=“strongly disagree” (*sangat tidak setuju*), 2=“agree” (*setuju*) and 3=“strongly agree” (*sangat setuju*). The scale for practice was also recoded into: 1= “never” (*tidak pernah*), 2= “seldom” (*jarang*), 3= “often” (*kebanyakan masa*) and 4= “always” (*selalu*). The purpose of recoding was because some coding has got very low respond rate or nil respond thus eliminating the extreme responses as suggested by Grandy (1996).

### 3.3 Exploratory Factor Analysis and Internal Consistency Reliability

**Table 2:** Result of factor analysis and reliability analysis of attitude and practice sections of FloodDMQ-BM

Factor	Items	Factor Loading	Cronbach's alpha
Attitude	A1	0.646	0.925
	A2	0.756	
	A3	0.709	
	A4	0.735	
	A5	0.742	
	A6	0.710	
	A7	0.757	
	A8	0.753	
	A9	0.522	
	A10	0.638	
	A11	0.743	
	A12	0.768	
	A13	0.760	
Practice	P1	0.731	0.935
	P2	0.608	
	P3	0.722	
	P4	0.769	
	P5	0.815	
	P6	0.653	
	P7	0.858	
	P8	0.656	
	P9	0.835	
	P10	0.682	
	P11	0.855	
	P12	0.687	

Extraction method: Principal axis factoring

Table 2 shows the result of factor analysis and reliability analysis of attitude and practice sections. For attitude section, the data matrix was factorable and assumptions to conduct EFA were met as indicated by a KMO value of 0.886 and Bartlett's test of sphericity being significant ( $P < 0.005$ ). Based on eigenvalue value of 7.1, observation of scree plot and cumulative percentage of variance of 54.6%, only one factor determined. All the items in the attitude section had factor loading of more than 0.5 and were retained. The internal consistency via Cronbach's alpha coefficient was 0.925. For the practice section, the data matrix was factorable and assumptions to conduct EFA were also met as indicated by KMO value of 0.925 and Bartlett's test of sphericity being significant ( $P < 0.005$ ). Based on eigenvalue value of 7.063, observation of scree plot and cumulative percentage of variance of 58.85%, only one factor determined. All 12 items in practice section had factor loading of more than 0.5 and were retained. The internal consistency via Cronbach's alpha coefficient was 0.935.

3.4 Item Response Theory analysis

Table 3: Item Response Theory parameters estimate of items of the knowledge section of the FloodDMQ-BM

Item after removal	Item parameters			S- $\chi^2$ fit index		
	Difficulty (SE)	Discrimination (SE)	Standardized loading	$\chi^2$	df	P
K1	0.30 (0.20)	1.24(0.50)	0.78	6.9689	2	0.0307
K2	-0.73(0.21)	1.92(0.78)	0.89	1.1329	2	0.5675
K3	-0.77(0.20)	2.07(0.78)	0.90	10.7892	2	0.0045
K4	3.30(2.32)	0.46(0.34)	0.42	3.2992	3	0.3477
K6	1.93(0.73)	1.43(0.85)	0.82	6.3548	2	0.1702
K7	6.88(8.10)	0.37(0.45)	0.34	6.7194	3	0.0814
K9	4.03(2.71)	0.73(0.56)	0.59	0.5879	2	0.7453
K10	1.82(0.94)	0.60(0.33)	0.52	2.0620	3	0.5596
K11	0.38(0.26)	0.86(0.34)	0.65	6.3548	3	0.0956

RMSEA = 0.086, M2=52.67, TLI=0.62, CFI=0.72

Abbreviations: S-  $\chi^2$ =Standardized  $\chi^2$ , RMSEA =Root Mean Square Error of Approximation, TLI=Tucker-Lewis Index, CFI= Comparative Fit Index

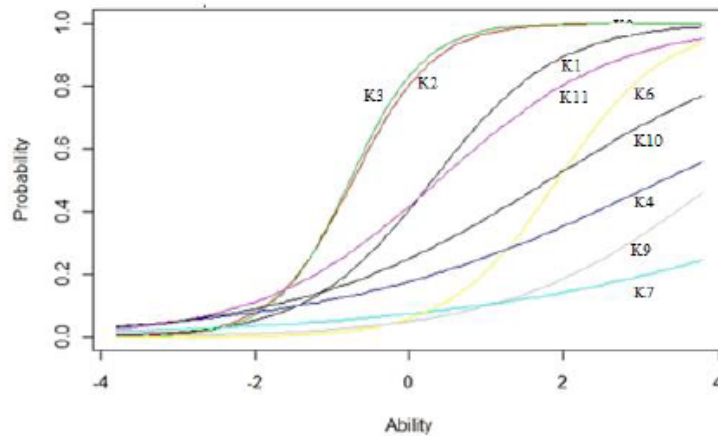


Figure 1: Item characteristics curve for items of knowledge section of FloodDMQ-BM after removal of items K5, K8 and K12 (n=9)

Based on 2PL model using IRT assessment of the knowledge section, item K5 and item K12 had a negative discrimination estimate of -0.04 and -0.13 respectively while item K8 had an extreme difficulty estimate of 91.48. These items were subsequently removed. The IRT analysis of the remaining items is summarised in Table 3. Item K7 had a high difficulty



estimate of 6.88 and low standardized loading value of 0.34 but was retained as it was important to assess knowledge. Two-way marginal fit for the finalized items in knowledge section had residues less than 4 and considered a good fit at 5% significant level (Bartholomew et al., 2008) The overall model data fit was adequate with a Root Mean Square Error of Approximation (RMSEA) value of 0.086 as suggested by Kenny & Kaniskan (2014) and statistically non significant of  $S-X^2$  as suggested by Orlando & Thissen (2003). All of the items had good standardized loading ranging from 0.3 to 0.9 and marginal reliability of 0.623 as suggested by Dimitrov (2003). There are finally 9 items retained in the final model of the knowledge section. Figure 1 shows the final Item Characteristic Curve of items in knowledge section of the FloodDMQ-BM.

### 3.5 Final model of FloodDMQ-BM

**Table 4:** Summary of FloodDMQ-BM items in all sections before and after psychometric analyses

Section	Before		After	
	Domain	Item	Domain	Item
Attitude	Alert system	3(A9,A10,A13)	Attitude	13(A1-A12)
	Communication	3(A1,A4,A11)		
	SOP	3(A5,A7,A12)		
	Transportation	4(A2,A3,A6,A8)		
Practice	Alert system	3(P5,P10,P12)	Practice	12(P1-P12)
	Communication	3(P1,P8,P11)		
	SOP	3(P4,P7,P9)		
	Transportation	3(P2,P3,P6)		
Knowledge	Alert system	3(K9,K11,K12)	Knowledge	9(K1,K2,K3, K4,K6,K7, K9,K10,K11)
	Communication	3(K1,K2,K3)		
	SOP	3(K7,K8,K10)		
	Transportation	3(K4,K5,K6)		

Table 4 summarizes the items in all sections of the Flood DMQ-BM before and after psychometric analysis. The final model of the knowledge section of FloodDMQ-BM has a total of 9 items. This amounts to a minimum score of 0 point and a possible maximum score of 9 points. Knowledge section with higher score indicates better knowledge of the healthcare provider. A total of 13 items were retained in the attitude section of the FloodDMQ-BM. Items will be rated on a 4-point scale although it was initially recoded into a 3-point scale to satisfy a polytomous scale of at least a 4-point scale (Streiner & Norman, 2008). Attitude on patient management during flood disaster can be evaluated by total score. The possible minimum score of this section is 13 points and possible maximum score is 52. All items were positively structured therefore reverse scoring does not apply to the attitude section. A higher total score in this section indicates a more positive attitude of the healthcare providers towards patient management during a flood disaster. A total of 12 items in the practise section that fit in the FloodDMQ-BM were retained. Total practice score can assess practice of good patient management during flood disaster. The possible minimum scoring is 12 and the possible maximum score is 48. All items were positively structured therefore reverse scoring does not

apply to the attitude section. A higher total score in this section indicates a better practice of the healthcare providers regarding patient management during a flood disaster.

#### 4.0 Discussion

The FloodDMQ-BM is able to serve as a useful tool as it has been designed and tailored to the healthcare providers providing patient care during flood disaster. In addition, the validity and reliability has been tested. This includes content validation by expert panel, face validation by healthcare providers of similar characteristics as the intended target group, construct validity using EFA and IRT and internal consistency reliability. For content validation, consensus was met in reviewing the FloodDMQ-BM based on the contents of the flood disaster response protocol. In the determination of face validation, comprehensibility of questions by the target group is vital, especially for instruments designed for specific population. Majority of the items designed in the FloodDMQ-BM were well understood by the healthcare providers with exception on certain terminologies, which were later revised to serve the purpose. It may be attributed to the nature of FloodDMQ-BM, which was developed based on patient management by healthcare providers during a flood disaster as well as Bahasa Malaysia language being the national language medium.

The polytomous scale items of attitude and practice sections were validated using EFA while the dichotomous scale items in the knowledge section used IRT. The EFA is essential to search the latent constructs of the items and thereby allowing some theory to be formulated. Using EFA, common factors can be extracted from the list of the items and the relationship among them can be determined. After regrouping, naming of the extracted factor is essential to reduce the variable complexity for greater simplicity. "Attitude" and "practice" are the renamed factors in the attitude and practise sections respectively after extraction replacing "communication", "alert", "SOP" and "transportation" factors. All the items in each section of attitude and practice share the same latent construct, which are named "attitude" and "practice" respectively. The decision to choose only 1 factor for each section was to minimize items overlapping and to obtain better factor loading. Finally, it will benefit the final outcome of the questionnaire, which is having good validity and reliability. Based on the EFA results, both attitude and practice sections had good construct validation and reliability.

Some items need to be removed from the knowledge section of FloodDMQ-BM in view of poor discrimination parameter such as item K5 and K12. In effect, item K5 and item K12 in poor knowledge respondents will have higher result as compared to good knowledge respondents. Good items such as item K1, K2, K3 and K6 will be able to differentiate between good and poor knowledge respondents.

The conventional way to interpret reliability using Cronbach's alpha is not meaningful in IRT analysis of the knowledge items because of its dichotomous type of questions as compared to polytomous type of attitude and practice sections (Stoop, 2011). The marginal reliability can estimate the average reliability among the respondent's knowledge (Thissen, 1986). The exact value of acceptable marginal reliability is not well documented but we based our statistical analysis on studies by Domitrov (2003) and Stoop (2011) that suggested a value of 0.623

being acceptable. Another point to note is that marginal reliability will be influenced by reduction of some items (Stoop, 2011). In this study, the removal of few items that had extreme results such as items K5, K8 and K12 had significantly improved the marginal reliability score of knowledge items.

The item's model fit had good RMSEA and non-significant M2 (Kenny & Kaniskan, 2014). We noted that both the CFI and TLI were 0.6 and 0.7 respectively. Acceptable CFI and TLI values should be more than 0.9 (Hooper et al., 2008). However, in view of good RMSEA result (less than 0.1), the CFI and TLI values can be ignored (Kenny, 2014).

The results of this self-report questionnaire will hopefully generate understanding on the KAP of healthcare providers and highlight knowledge gaps as well as identifying potentials and capabilities for improved health service resilience. It can also serve as an indicator of intervention effectiveness put in place to mitigate risks of flood disaster in health care systems. This limitation of this study was in the sample size. IRT requires a sample size for at least 200 (Kenny, 2014). However, in this study, the sample size was only 131 due to availability of healthcare providers willing to spend time completing the questionnaire.

## 5.0 Conclusion and recommendation

The FloodDMQ-BM has shown to have good psychometric properties. It is a valid and reliable instrument to evaluate knowledge, attitude and practice of health care provider regarding patient's management during flood disaster. In the future, the suggestion is to recruit more samples so that the IRT components, standard loading and marginal reliability will be improved. The other limitation of this study was it is only confined to the health care provider in Hospital USM, which is a tertiary hospital. Therefore multi-centre validation study involves the government hospital and local clinic should be conducted in the future to determine the validity and reliability of the FloodDMQ-BM onto a wider population. We would also like to suggest future study to be conducted to substantiate the theory generated by this EFA result by confirmatory factor analysis.

## Acknowledgement

Ethical approval for this study was obtained from Human Research Ethics Committee Universiti Sains Malaysia (USM/JEPeM/15100333). Our special thanks to the School of Medical Sciences, Universiti Sains Malaysia for supporting this study. Our appreciation to all the staffs in Hospital USM involved in this study and biostatistician students for their help. This study was funded by Ministry of Education Malaysia Trans-Disiplinary Research Grant Scheme (TRGS). The FloodDMQ-BM is copyrighted to Universiti Sains Malaysia.



## Declaration

Authors declare that there was no conflict of interest in this study.

## Authors contribution

Author 1: data collection, Author 2: manuscript writing, Author 3:  
Author 4: statistical analysis and Author 5: data interpretation and discussion

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POSTER PRESENTATION AT THE 21<sup>ST</sup> NATIONAL CONFERENCE ON MEDICAL AND HEALTH SCIENCES 2016 ON 17<sup>th</sup>-18<sup>th</sup> OCTOBER 2016



# DEVELOPMENT AND PSYCHOMETRIC EVALUATION OF FLOOD DISASTER MANAGEMENT QUESTIONNAIRE (FloodDMQ-BM<sup>®</sup>): EXPLORATORY FACTOR ANALYSIS AND ITEM RESPONSE THEORY ANALYSIS

**1** Department of Emergency Medicine, School of Medical Sciences, Universiti Sains Malaysia, Kubang Keratan 06000 Kubang, Malacca

**2** Unit of Restorative and Prosthetic Orthodontics, School of Medical Education, Universiti Sains Malaysia, Subang Keratan, 06100 Kubang, Malacca

**3** Department of Surgery, Faculty of Medicine and Health Sciences, Universiti Sains Malaysia, Kubang Keratan, Malacca

**4** Department of Psychology, School of Medical Sciences, Universiti Sains Malaysia, Kubang Keratan 06000 Kubang, Malacca

**INTRODUCTION**

Flood catastrophe has a major impact on healthcare services in Malaysia. However, there is no validated tool to measure the knowledge, attitude and practice of flood disaster management among healthcare providers involved in the response phase of a flood disaster in Malaysia. We aim to develop and validate a questionnaire in Bahasa Malaysia (FloodDMQ-BM); to measure the level of knowledge, attitude and practice of flood disaster management among healthcare providers.

**OBJECTIVE**

To develop, validate and perform psychometric analysis on each section in FloodDMQ-BM questionnaire (Knowledge, Attitude and Practice).

**METHODS**

The questionnaire was developed based on four domains: standard operating procedure, transportation, alert system and communication. Psychometric analyses were tested on healthcare providers involved in patient management during flood disaster in Kelantan. The hypothetical concept of the items in attitude and practice sections was assessed using Exploratory Factor Analysis (EFA) and internal consistency reliability. The knowledge section, were analysed using 2-parameter logistic model of Item Response Theory.

**RESULTS & DISCUSSION**

20 items were generated for FloodDMQ-BM. For both the attitude and practice items, the EFA have good factor loading ( $>0.5$ ) and satisfactory internal consistency of 0.820 and 0.635 respectively. The remaining items in the knowledge section have good marginal fit and adequate Root Mean Square Error of Approximation of 0.06. All the remaining items have good standardized loading ( $>0.3$ ) and marginal reliability of 0.623.

**Table 1:** Results of factor analysis and reliability estimates of attitude and practice sections of FloodDMQ-BM

Item	Attitude	Practice	Internal Consistency
1	0.75	0.65	0.82
2	0.72	0.62	0.81
3	0.70	0.60	0.80
4	0.68	0.58	0.79
5	0.65	0.55	0.78
6	0.63	0.53	0.77
7	0.60	0.50	0.76
8	0.58	0.48	0.75
9	0.55	0.45	0.74
10	0.53	0.43	0.73
11	0.50	0.40	0.72
12	0.48	0.38	0.71
13	0.45	0.35	0.70
14	0.43	0.33	0.69
15	0.40	0.30	0.68
16	0.38	0.28	0.67
17	0.35	0.25	0.66
18	0.33	0.23	0.65
19	0.30	0.20	0.64
20	0.28	0.18	0.63

**Table 2:** Item Response Theory parameters estimate of items of knowledge section of FloodDMQ-BM

Item	Difficulty (a)	Discrimination (b)	Guessing (c)	Upper Asymptote (d)	Lower Asymptote (e)	Information (f)
1	0.12	1.85	0.05	1.00	0.00	1.80
2	0.15	1.75	0.05	1.00	0.00	1.70
3	0.18	1.65	0.05	1.00	0.00	1.60
4	0.22	1.55	0.05	1.00	0.00	1.50
5	0.25	1.45	0.05	1.00	0.00	1.40
6	0.28	1.35	0.05	1.00	0.00	1.30
7	0.32	1.25	0.05	1.00	0.00	1.20
8	0.35	1.15	0.05	1.00	0.00	1.10
9	0.38	1.05	0.05	1.00	0.00	1.00
10	0.42	0.95	0.05	1.00	0.00	0.90
11	0.45	0.85	0.05	1.00	0.00	0.80
12	0.48	0.75	0.05	1.00	0.00	0.70
13	0.52	0.65	0.05	1.00	0.00	0.60
14	0.55	0.55	0.05	1.00	0.00	0.50
15	0.58	0.45	0.05	1.00	0.00	0.40
16	0.62	0.35	0.05	1.00	0.00	0.30
17	0.65	0.25	0.05	1.00	0.00	0.20
18	0.68	0.15	0.05	1.00	0.00	0.10
19	0.72	0.05	0.05	1.00	0.00	0.05
20	0.75	0.00	0.05	1.00	0.00	0.00

**CONCLUSION**

The results suggested that the FloodDMQ-BM has valid and reliable psychometric properties.

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**Figure 1:** Item characteristics curves for items of knowledge section of FloodDMQ-BM after removal of items 19 and 20.



**Table 3:** Summary of FloodDMQ-BM items of sections: Knowledge, Attitude and Practice.

Item	Section	Item	Section	Item
1	Knowledge	11	Attitude	21
2	Knowledge	12	Attitude	22
3	Knowledge	13	Attitude	23
4	Knowledge	14	Attitude	24
5	Knowledge	15	Attitude	25
6	Knowledge	16	Attitude	26
7	Knowledge	17	Attitude	27
8	Knowledge	18	Attitude	28
9	Knowledge	19	Attitude	29
10	Knowledge	20	Attitude	30
11	Knowledge	21	Practice	31
12	Knowledge	22	Practice	32
13	Knowledge	23	Practice	33
14	Knowledge	24	Practice	34
15	Knowledge	25	Practice	35
16	Knowledge	26	Practice	36
17	Knowledge	27	Practice	37
18	Knowledge	28	Practice	38
19	Knowledge	29	Practice	39
20	Knowledge	30	Practice	40

**Author information**

Contact: **Dr. Mohd Najib bin Abdul Ghani**, Department of Emergency Medicine, School of Medical Sciences, Universiti Sains Malaysia, 11200 Kubang Keratan, Malacca. Tel: 09-7673225







## ABSTRACT

**Background:** Flood catastrophe has a major impact on healthcare service in most parts of Malaysia. However, there is no validated measurement tool to measure the knowledge, attitude and practice of flood disaster management among healthcare providers involved in the response phase of a flood disaster in Malaysia.

**Objective:** The objective of this study is to develop and validate a questionnaire in Bahasa Malaysia (FloodDMQ-BM) to measure the level of knowledge, attitude and practice of flood disaster management among healthcare providers.

**Methods:** The questionnaire was developed based on four domains: standard operating procedure, transportation, alert system and communication. 36 items, answered on a 5-point Likert scale, were generated and underwent content and face validations. The hypothetical concept of the items in attitude and practice sections was assessed using Exploratory Factor Analysis (EFA) and internal consistency reliability. The knowledge section were analyzed using 2-parameter logistic model of Item Response Theory.

**Results:** For both the attitude and practice items, the EFA have good factor loading ( $>0.5$ ) and satisfactory internal consistency of 0.925 and 0.935 respectively. The remaining items in the knowledge section have good marginal fit and adequate Root Mean Square Error of Approximation of 0.08. All the remaining items have good standardized loading ( $>0.3$ ) and marginal reliability of 0.623.


**Conclusion:** The results suggest that the FloodDMQ-BM has valid and reliable psychometric properties.

**Keywords:** Flood, disasters, questionnaire, psychometric

## Poster Presentations: Health Sciences

No.	Presenter	Title
PH01	Mohd Najib bin Abdul Ghani	Development and psychometric evaluation of flood disaster management questionnaire (FloodDMQ-BM): exploratory factor analysis and item response theory analysis
PH02	Ooi Foong Kiew	Comparisons of bone speed of sound and physical fitness components between physically and non-physically active young Malays and Yunnan Chinese
PH03	Tuan Salwani bt Tuan Ismail	Determination of optimum vitamin D level for bone health based on bone turn over markers among healthy adults in Kota Bahru
PH04	Haslinda binti Dan	Standardized patients (SPs) used in communication skills assessment: are they authentic or artificial?
PH05	Aida Maziha binti Zainudin	The effect of Islamic mindfulness on nicotine withdrawal symptoms among Muslim men attending Klinik Rawatan Keluarga HUSM
PH06	Norshila Fauzi	Water contamination by heavy metals post-flood event: health implications
PH07	Chen Chee Keong	Effects of honey supplementation during recovery on subsequent running performance and selected physiological parameters in the heat
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PH09	Nor Ilyani binti Abdullah	Prevalence of depression among community dwelling elderly in Kelantan: a year after flood disaster
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PH12	Esther Rishma Sundram	Dysphonia (voice disorders): its prevalence and risk factors among primary school teachers in Kota Bharu, Kelantan
PH13	Mohamad Zaidi bin Saad	Knowledge, attitude and practice level of dengue fever management among medical officers of Hospital Universiti Sains Malaysia, Kelantan

**POSTER PRESENTATION AT THE KUALA KRAI**  
**Event: Program Memasyarakatkan Hasil Kajian Kesehatan Berkaitan Banjir**  
**Kelantan**  
**Date: 29<sup>th</sup> October 2016**



## KAJIAN KEBERKESANAN PROTOKOL BERSEPADU PENGURUSAN PERUBATAN SEMASA BENCANA BANJIR DI KELANTAN

PENYELIDIK

● Dr Tuan Hairulnizam Tuan Kamaruzaman ● Dr Mohd Fagroll Mohd Fudzi ● Dr Mohd Najib Abdul Ghani ● Prof Dr Nik Hisamuddin Nik Ab Rahman  
● Prof Dr Chew Keng Sheng ● Dr Shaharudin Shah Che Harzah ● Dr Abu Yazid Md Noh


### KEPERLUAN PENYELIDIKAN

Perkhidmatan perubatan amat penting semasa masa respon bencana banjir di Kelantan.

Perkhidmatan ini, yang melibatkan pelbagai agensi kerajaan, terjejas teruk semasa bencana banjir akibat daripada pelbagai faktor.

Antara puncanya adalah terdapat gajspanduan respon perubatan yang pelbagai, tidak seragam dan tidak spesifik antara agensi-agensi terlibat.

Penyerahan buku protokol kepada Dato' Dr. Ahmad Razin bin Dato' Haji Ahmad Mahir, Pengarah JKKN, semasa FloodTEX 2015 pada 7th December 2015



### (1) KADAR MENGIKUR KESAN PROTOKOL PERUBATAN BERSEPADU (PPB) KEATAS PENGETAHUAN, SIKAP DAN AMALAN (RUPA) PENYAMPAI PERUBATAN YANG TERLIBAT DALAM PENGURUSAN PESAKIT SEMASA BENCANA BANJIR

■ Penilaian semesta kesihatan yang terlibat berkaitan dengan bencana banjir di Kelantan  
■ Ciri-ciri demografi (PBB) dan bencana bencana banjir banjir  
■ Kualiti kesihatan responden yang terlibat

■ Status kesihatan pesakit berkaitan bencana banjir  
■ Ciri-ciri demografi pesakit berkaitan bencana banjir  
■ Profil kesihatan pesakit berkaitan bencana banjir


### TUJUAN PENYELIDIKAN

Kami mengkaji keberkesanan Protokol Bersepadu Pengurusan Perubatan Semasa Bencana Banjir Di Kelantan keatas tahap pengetahuan, sikap dan amalan respon perubatan pengamal perubatan yang bertugas semasa bencana banjir di Kelantan.

### (2) PENULISAN, VALIDASI & KAJIAN PSIKOMETRIK BORANG SOALSELIDIK FLOODQI-BMI UNTUK MENILAI TAHAP PENGETAHUAN, SIKAP DAN AMALAN PENGURUSAN BANJIR

■ Menentukan alat pengukur pengetahuan  
■ Menentukan alat pengukur sikap dan amalan  
■ Menentukan alat pengukur amalan

■ Menentukan kesahihan (Cronbach's alpha)  
■ Menentukan reliabiliti (Cronbach's alpha)  
■ Menentukan faktor faktor berkaitan dengan "New Characteristic Curve" bahagian pengetahuan  
■ Menentukan alat pengukur amalan



### (1) PERBINCANGAN FOKUS (FGD)

■ FGD dijalankan kepada 10 orang yang melibatkan 10 orang responden yang terlibat dalam pengurusan pesakit semasa banjir di Kelantan  
■ 10 orang responden yang terlibat

■ 10 orang responden yang terlibat  
■ 10 orang responden yang terlibat  
■ 10 orang responden yang terlibat

### Keputusan 'factor analysis' dan 'reliability analysis' bahagian sikap dan amalan


Item	Factor 1	Factor 2
1	0.85	0.05
2	0.78	0.12
3	0.82	0.08
4	0.75	0.15
5	0.80	0.10
6	0.72	0.18
7	0.83	0.07
8	0.76	0.14
9	0.81	0.09
10	0.74	0.16
11	0.84	0.06
12	0.77	0.13
13	0.82	0.08
14	0.75	0.15
15	0.80	0.10
16	0.72	0.18
17	0.83	0.07
18	0.76	0.14
19	0.81	0.09
20	0.74	0.16
21	0.84	0.06
22	0.77	0.13
23	0.82	0.08
24	0.75	0.15
25	0.80	0.10
26	0.72	0.18
27	0.83	0.07
28	0.76	0.14
29	0.81	0.09
30	0.74	0.16

### Perbandingan skor pengetahuan, sikap dan amalan antara kumpulan intervensi dan kawalan

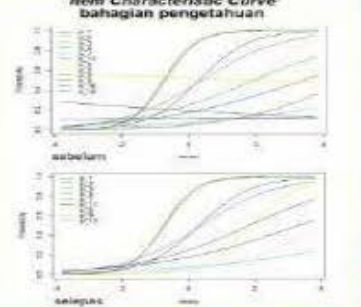
Intervensi	Subjek	Pengetahuan (Mean)	Sikap (Mean)	Amalan (Mean)
Kawalan	Subjek 1	7.100 (50)	27.00 (3.0)	10.00
	Subjek 2	7.800 (51)	30.00 (3.0)	10.00
	Subjek 3	7.900 (52)	27.00 (3.0)	10.00
Intervensi	Subjek 4	10.000 (60)	30.00 (3.0)	10.00
	Subjek 5	10.000 (60)	30.00 (3.0)	10.00
	Subjek 6	10.000 (60)	30.00 (3.0)	10.00

### PENERBITAN BUKU PROTOKOL

**BENCANA**  
 PROSEDUR PERUBATAN BERSEPADU PENGURUSAN PESAKIT SEMASA BENCANA BANJIR DI KELANTAN  
 November 2015  
 ISBN 979-367-0486-63-3



### 'New Characteristic Curve' bahagian pengetahuan



### KESIMPULAN

■ PPB meningkatkan tahap pengetahuan dan amalan pengamal perubatan yang terlibat pengurusan pesakit semasa banjir di Kelantan.  
■ FloodQI-BMI<sup>®</sup> adalah alat soalselidik yang telah diuji berkesan mengukur tahap pengetahuan, sikap dan amalan pengurusan pesakit semasa bencana banjir.



## AWARDS



**CITATION:**

**The impact of floods in hospital and mitigation measures: A literature review**

**N A Yusoff<sup>1</sup>, H Shafiq<sup>1</sup> and R Omar<sup>1</sup>**

<sup>1</sup>Faculty of Technology Management and Business, Universiti Tun Hussein Onn Malaysia, 86400 Parit Raja, Batu Pahat, Johor, Malaysia  
 Corresponding author: arecni1804@yahoo.com

**Abstract.** In late December 2014, the flood was most significant and largest recorded specifically in the Kelantan, Malaysia. It was considered to be a "tsunami like disaster" in which 202,000 victims were displaced and causing widespread collapse of public infrastructure. Flooding of hospital results in interruption of business, loss of infrastructure, such as electrical power and water supplies, increased difficulty in providing routine medical and increased patient admissions and nursing care for patients with chronic diseases, such as renal failure, diabetes, cancer, cystic fibrosis and mental illness. The aimed of this paper to identify the best of measures for reduce the risk of flood in hospital. Method of this paper uses the previous study result. Several related previous study can be used as measures to mitigation flood risk in Malaysian hospitals. Early stage research of related studies hope to help add more information to assist researchers in reducing the risk of flooding in hospital. The findings with proper pre-event preparation framework for mitigation flood risk of hospitals, the continuing medical services can be provided to patient especially during emergency.

**Development and Validation of Knowledge on Cerebral Palsy Questionnaire (KCP-Q) Using Item Response Theory (IRT)**  
 Azimulah A.Z, Ki Mosa, Ismail M, Yasecob NS, Sill Hava

**Introduction**

- Understanding and awareness about CP are still lacking among community. Studies showed improve knowledge on CP will reduce the stigmatisation towards the disability
- To date, there are limited questionnaires examine general knowledge on CP among community.

**Objective**

- To develop and validate a tool to assess general knowledge on CP among community volunteers (CV).

**Methodology: 2 Phases**

**Phase 1: Questionnaire Development**

- Generation of questionnaires items:** Following extensive literature review based on key concepts that CV expected to know.
- Content validation:** Reviewed by expert (Paediatricians, Physiotherapy, Public Health Consultant and Occupational therapists).
- Face validation:** 5 CVs to review Questionnaire appropriateness.

**Phase 2 : Psychometric Assessment**

- Study design:** A Cross sectional study
- Study Sample:** CV from community leaders, nurses, community based rehabilitation (CBR) teachers and social workers.
- Study tools:** 28 items self administered Preliminary Questionnaire.
- Study Analysis:** 2-parameter logistic model of IRT using R software version 3.3.4.

**Result**

Table 1 : Item Response theory parameters estimate of items of the knowledge section of KCP- Questionnaire

Item parameters	Difficulty	Discrimination	X <sup>2</sup>	df	p	S-X <sup>2</sup> fit Index	Marginal reliability
Q1	-0.73	3.23	2.89	3	0.41		
Q2	-0.38	1.26	10.22	8	0.25		
Q3	-1.27	2.67	0.39	1	0.53		
Q4	-0.58	3.50	1.41	5	0.92		
Q7	-1.00	2.82	1.75	2	0.42		
Q8	0.74	0.76	5.85	7	0.56		
Q9	-0.52	2.51	5.01	5	0.42		
Q10	-0.85	3.89	3.35	2	0.31		
Q12	-0.60	1.21	4.72	8	0.79		
Q13	-0.70	34.46	0.40	1	0.37		
Q14	0.25	1.12	4.45	4	0.31		
Q15	0.13	3.79	3.25	7	0.63		
Q16	0.73	0.77	8.82	7	0.26		
Q17	0.64	1.53	4.13	4	0.36		
Q18	-0.15	0.87	4.13	3	0.39	0.865	
Q19	0.04	0.77	2.54	10	0.99		
Q20	1.02	1.70	3.00	2	0.22		
Q21	0.64	1.15	3.95	6	0.69		
Q22	-0.71	31.38	5.89	2	0.06		
Q23	1.13	0.73	17.13	7	0.02		
Q24	-0.51	1.04	1.70	2	0.43		
Q25	0.83	1.27	11.09	6	0.09		
Q26	-0.57	1.56	3.85	5	0.37		
Q27	0.70	1.14	7.03	6	0.53		
Q28	-0.98	1.05	11.19	6	0.39		

**Discussion/Conclusion**

- A total of 61 CVs answered the questionnaire.
- Based on 2 parameter logistic (PL) model of IRT, 3 items were removed (Q5, Q6 and Q11) due to poor difficulties and discriminative index. The marginal reliability of the final questionnaire was 0.865.
- 25 items remained in the final questionnaire

**References**

- Edelen, M. O. and B. B. Reeve (2007). "Applying item response theory (IRT) modeling to questionnaire development, evaluation, and refinement." *Quality of Life Research* 16(1): 5.
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**ACKNOWLEDGEMENT:** The authors wish to express our gratitude to all participants (CVs) who participated in the development and validation of the KCP-Q. The authors also wish to thank all those who assisted in the development of the KCP-Q.

## **PERMISSION TO USE QUESTIONNAIRE (FLOODDMQ-BM):**

**1)From:** Noorain Yusoff <arein1804@yahoo.com>  
**Sent:** Tuesday, August 1, 2017 6:17:02 PM  
**To:** Tuan Hairulnizam Tuan Kamauzaman  
**Subject:** Re: pertanyaan

Assalamualaikum/Salam sejahtera

Tuan/Puan

MEMOHON KEBENARAN MENGGUNAKAN BORANG SOAL SELIDIK

Saya Noor Ain Binti Yusoff pelajar PhD dari Universiti Tun Hussein Onn Malaysia yang sedang menjalan penyelidikan bertajuk "membangunkan pelan pengurusan pencegahan risiko bencana banjir terhadap hospital kerajaan".

2. Di sini saya ingin memohon kebenaran daripada pihak Tuan untuk menggunakan dan mencetak borang soal selidik yang pernah pihak Tuan lampirkan kepada saya seperti yang saya lampirkan di bawah. Jika dibenarkan, saya akan menggunakan borang soal selidik ini hanya untuk tujuan penyelidikan saya sahaja dan segala maklumat yang ada dalam borang soal selidik adalah dianggap sulit.

3. Segala kerjasama daripada pihak tuan amatlah dihargai dan didahului dengan ucapan ribuan terima kasih.

sekian terima kasih.

**2)From:** Noorain Yusoff <arein1804@yahoo.com>  
**Sent:** Sunday, February 12, 2017 12:34 PM  
**To:** Tuan Hairulnizam Tuan Kamauzaman  
**Subject:** Re: pertanyaan

Assalamualaikum

ok.Baik Dr.. tajuk kajian saya Membangunkan Pelan Pengurusan Risiko Bencana Banjir untuk Pencegahan di

Hospital-Hospital Kerajaan. sy memilih 3 buah hospital di Kelantan HPRZ II, H.Kuala Krai dan H.Pasir Mas untuk dijadikan sebagai kajian kes.sekarang sy sedang siapkan soalan temubual dan soal selidik.

**3)From:** Noorain Yusoff <arein1804@yahoo.com>

**Sent:** Wednesday, August 2, 2017 10:04:22 AM

**To:** Tuan Hairulnizam Tuan Kamauzaman

**Subject:** Re: pertanyaan

Walaikumussalam

Insha Allah. Terima kasih doakan Untuk PhD saya.Terima kasih tak terhingga juga kepada pihak Tuan Kerana Membenarkan saya menggunakan borang selidik (FloodDMQ) ini. Segala jasa baik daripada pihak Tuan amatlah saya hargai.

# **CHAPTER 1**

# **INTRODUCTION**



In late December 2014, Kelantan state experienced the worst flood disaster since 1927 and considered to be a “tsunami like disaster” displacing 202,000 victims and causing widespread collapse of public infrastructure. Kelantan faces Northeast monsoon from November to March each year and compounded by unplanned urbanization, geographical characteristic and land use planning, triggered the severe flood (Baharuddin et al., 2015). Healthcare facilities were severely affected by the flood and patients had difficulties receiving medical treatment in a timely and effective manner as most of the healthcare facilities and public amenities were located on the flood plain. The main general hospital of Kelantan, Hospital Raja Perempuan Zainab II, were among the earliest hospital being malfunctioned followed by many district hospitals leaving Hospital Universiti Sains Malaysia as the only referral hospital that stood on dry ground during the whole disaster period.

Few important issues were identified in managing patient during the response phase of the flood disaster namely alert and warning systems, transportation, communication and command and control. These were the findings discovered and frequently highlighted by participants in a qualitative study among healthcare providers managing patient during flood disaster Kelantan (Tuan Kamauzaman et al., 2015). We included these components as domains in each of the knowledge, attitude and practice sections of the KAP questionnaire.

This study was aimed to develop a valid and reliable questionnaire in Bahasa Malaysia assessing the knowledge (K), attitude (A) and practice (P) among the health care providers pertaining to patient’s management during flood disaster in Malaysia, known as FloodDMQ-BM. A good questionnaire can be adapted to any cultures, different places and times and yet raising similar

results. A series of validation steps in this study such as face validation, content validation and construct validation is to ensure that FloodDMQ-BM is well validated before it can be applied to the target group (Streiner& Norman, 2008). Until now there is no data published on the psychometric characteristics of a KAP questionnaire measuring KAP of healthcare providers managing patients during flood disaster in Malaysia. This study provides evidence of validity and reliability of FloodDMQ-BM so that it can be utilized as an instrument to assess the KAP of healthcare providers involved in flood disaster management in Malaysia.

# **CHAPTER 2**

# **LITERATURE REVIEW**

## **2.1 Flood disaster**

Floods are natural disaster due to excess rainfall in certain seasons because water levels of rivers and lakes overflowed and went into the surroundings (Lin *et al.*, 2013; Abidin, 2010). Floods can create multiple damage to the properties and loss of life. Scenario flooding and destruction from flooding not only recorded in Malaysia but also throughout universe. According to the World Meteorological Organisation (WMO) labelling the floods as three worst natural disasters and has claimed thousands of lives and destruction of property values hundred thousand million (Hussain *et al.*, 2015). A record number of floods in Malaysia established in year 1926, 1931, 1947, 1954, 1957, 1963, 1965, 1967, 1969, 1971, 1973, 1983, 1988, 1993, 1998, 2001, 2006, 2007 and 2010. Reports from Department of Irrigation and Drainage stated that about 29,000 square kilometers, or 9% of the total area and more than 4.82 million people (22%) of the population affected by floods every year (Chan, 2015).

Floods are an annual occurrence involve state on the east coast of Peninsular Malaysia such as Pahang, Terengganu and Kelantan. During December 2014, the flood was most bizarre and largest recorded setting in Kelantan. It been labelled as “tsunami like disaster” as high as 202,000 victims were affected and widespread collapse of public accomodation (Baharuddin *et al.*, 2015). Kelantan faces Northeast monsoon from November to March each year and compounded by unplanned urbanization, geographical characteristic and land use planning, triggered the severe flood (Khan *et al.*, 2014). Healthcare facilities were severely affected by the flood and patients had difficulties receiving medical treatment in a timely and effective manner as most of the healthcare facilities and public amenities were located on the flood plain.

## **2.2 Exploratory Factor Analysis**

Exploratory factor analysis (EFA) is a broadly utilized and widely applied statistical method in the medical health sciences. In recently previous studies, EFA was used for a variety of applications, including developing an instrument and tool (Lovett *et al.*, 2002).

EFA commonly used in the fields of psychology and education (Hogarty *et al.*, 2005) and is considered the method of choice to interpret self-reporting questionnaires. EFA is a multivariate statistical procedure that has many benefits and advantages (Gorsuch, 1983; Hair *et al.*, 1995, Tabachnick and Fidell, 2007; Thompson, 2004). Firstly, EFA reduces many items into a smaller set of variables (also referred to as domain, factor or construct). Secondly, it establishes underlying dimensions between measured variables and latent constructs, thereby allowing the formation and establishment of theory. Thirdly, it provides construct validity evidence of self-reporting scales.

In EFA, the investigator has no expectations of the number or nature of the variables and as the title suggests, it is exploratory in nature. That is, it allows the researcher to explore the main dimensions to generate a theory, or model from a relatively large set of latent constructs often represented by a set of items (Pett *et al.*, 2003; Henson and Robert, 2006; Thompson, 2004; Swisher *et al.*, 2004).

## **2.3 Item Response Theory Analysis**

A modern health outcomes tool is developed based on the principles of item response theory (IRT) (Reeve *et al.*, 2007). IRT comprises a collection of modeling techniques for the analysis of

item level data (e.g., in health status). IRT has been used to evaluate the psychometric properties of an existing scale and its latent trait, comprehensively reduced the scale, and to further evaluation of the performance of the reduced scale. When used appropriately, IRT model can produce a valid and hence resulting in minimal response burden. Health outcomes researchers are increasingly applying Item Response Theory (IRT) methods to questionnaire development, evaluation, and established the psychometric properties of the tool.

The item characteristic curve (ICC) is the basis of IRT, and is most commonly defined as a logistic function that representing a connection between a person's response to an item and the level on the construct measured by the scale. There are several different parametric unidimensional IRT models available (Thissen and Steinberg, 1986). The first consideration when choosing the right model involves the number of item response categories. For dichotomous items, the 1, 2, and 3 parameter logistic models are most common (1PL, 2PL, 3PL), and models including an upper asymptote parameter (e.g., 4PL) are also possible. The two-parameter logistic (2PL) model is the widely been used for dichotomous items. Regardless of the number of item responses, the ICCs from an IRT provide a visual representation of item properties that can be useful in scale development and refinement.

The discrimination parameter represents the slope of the ICC at the value of the location parameter and indicates the extent to which the item is related to the underlying construct. A steeper slope indicates a closer relationship to the construct and therefore a more discriminating item (Edeelen and Reeve, 2007).

# **CHAPTER 3**

# **OBJECTIVES**

### **3.1 GENERAL OBJECTIVE:**

To develop and validate a Malay language questionnaire to evaluate knowledge, attitude and practice (KAP) of flood disaster management (FloodDMQ-BM) among health care workers in Kelantan.

### **3.2 SPECIFIC OBJECTIVE:**

1. To determine the validity of FloodDMQ-BM using content validation
2. To determine the face validation of FloodDMQ-BM and performing a pre-testing
3. To determine the construct validity of FloodDMQ-BM using exploratory factor analysis (EFA) and item response theory (IRT) analysis.
4. To determine the reliability of FloodDMQ-BM by assessing the internal consistency of domains using Cronbach's Alpha.



# **CHAPTER 4**

# **MANUSCRIPT**

#### **4.1 Manuscript Title Page**

### **DEVELOPMENT AND VALIDATION OF A QUESTIONNAIRE TO EVALUATE KNOWLEDGE, ATTITUDE AND PRACTICE (KAP) OF FLOOD DISASTER MANAGEMENT (FloodDMQ-BM) AMONG HEALTH CARE WORKERS IN KELANTAN**

**Authors:** Mohd Najib Abdul Ghani<sup>1</sup>, Tuan Hairulnizam Tuan Kamauzaman<sup>1</sup>, Mohd Faqhrol Mohd Fudzi<sup>1</sup> Wan Nor Arifin Wan Nasir<sup>2</sup>, Chew Keng Sheng<sup>3</sup>

<sup>1</sup>Department of Emergency Medicine,  
School of Medical Sciences, Universiti Sains Malaysia,  
16150 Kota Bharu, Kelantan.

<sup>2</sup>Unit of Biostatistics and Research Methodology,  
School of Medical Sciences, Universiti Sains Malaysia,  
16150 Kota Bharu, Kelantan.

<sup>3</sup>Department of Surgery, Faculty of Medicine and Health Sciences,  
Universiti Malaysia Sarawak,  
Kota Samarahan, Sarawak, Malaysia

Corresponding author:

Tuan Hairulnizam Tuan Kamauzaman,

MBChB (Leeds) MMed (Emergency Medicine) USM

Senior Lecturer/Consultant

Emergency Medicine

Department of Emergency Medicine, School of Medical Sciences, Universiti Sains Malaysia,  
16150 Kota Bharu, Kelantan, MALAYSIA

Email: [hairulnizam@usm.my](mailto:hairulnizam@usm.my); Tel: +609-767000 ext6977/+6012-9875007; Faks: +609-7673219

# DEVELOPMENT AND VALIDATION OF A QUESTIONNAIRE TO EVALUATE KNOWLEDGE, ATTITUDE AND PRACTICE (KAP) OF FLOOD DISASTER MANAGEMENT (FloodDMQ-BM) AMONG HEALTH CARE WORKERS IN KELANTAN

Abdul Ghani M.N.<sup>1</sup>, Tuan Kamauzaman T.H.<sup>1\*</sup>, Mohd Fudzi M.F.M.<sup>1</sup>  
Arifin W.N.<sup>2</sup>, Chew K.S.<sup>3</sup>

<sup>1</sup> Department of Emergency Medicine, School of Medical Sciences, Universiti Sains Malaysia, Kubang Kerian 16150 Kelantan, Malaysia

<sup>2</sup> Unit of Biostatistics and Research Methodology, School of Medical Sciences, Universiti Sains Malaysia, Kubang Kerian 16150 Kelantan, Malaysia

<sup>3</sup> Department of Surgery, Faculty of Medicine and Health Sciences, Universiti Malaysia Sarawak, Kota Samarahan, Sarawak, Malaysia

*\*Corresponding author: Tuan Hairulnizam Tuan Kamauzaman, hairulnizam@usm.my*

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## ABSTRACT

**Background:** Flood catastrophe has a major impact on healthcare service in Malaysia. However, there is no validated tool to measure the knowledge, attitude and practice of flood disaster management among healthcare providers involved in the response phase of a flood disaster in Malaysia. We aim to develop and validate a questionnaire in Bahasa Malaysia (FloodDMQ-BM) to measure the level of knowledge, attitude and practice of flood disaster management among healthcare providers.

**Materials and Methods:** The questionnaire was developed based on four domains: standard operating procedure, transportation, alert system and communication. Psychometric analyses were tested on healthcare providers involved in patient management during flood disaster in Kelantan. The hypothetical concept of the items in attitude and practice sections was assessed using Exploratory Factor Analysis (EFA) and internal consistency reliability. The knowledge section was analysed using 2-parameter logistic model of Item Response Theory.

**Result:** 36 items were generated for FloodDMQ-BM. For both the attitude and practice items, the EFA have good factor loading (>0.5) and satisfactory internal consistency of 0.925 and 0.935 respectively. The remaining items in the knowledge section have good marginal fit and adequate Root Mean Square Error of Approximation of 0.08. All the remaining items have good standardized loading (>0.3) and marginal reliability of 0.623.

**Conclusion:** The results suggested that the FloodDMQ-BM has valid and reliable psychometric properties.

**Keywords:** Flood, disasters, questionnaire, validate, psychometric, healthcare providers

## **1.0 Introduction**

In late December 2014, Kelantan state experienced the worst flood disaster since 1927 displacing 202,000 victims and causing widespread collapse of public infrastructure. Kelantan faces Northeast monsoon from November to March each year and compounded by unplanned urbanization, geographical characteristic and land use planning, triggered the severe flood (Baharuddin et al., 2015). Healthcare facilities were severely affected by the flood and patients had difficulties receiving medical treatment in a timely and effective manner as most of the healthcare facilities and public amenities were located on the flood plain. The main general hospital of Kelantan, Hospital Raja Perempuan Zainab II, were among the earliest hospital being malfunctioned followed by many district hospitals leaving Hospital Universiti Sains Malaysia as the only referral hospital that stood on dry ground during the whole disaster period.

Few important issues were identified in managing patient during the response phase of the flood disaster namely alert and warning systems, transportation, communication and command and control. These were the findings discovered and frequently highlighted by participants in a qualitative study among healthcare providers managing patient during flood disaster Kelantan (Tuan Kamauzaman et al., 2015). We included these components as domains in each of the knowledge, attitude and practice sections of the KAP questionnaire.

This study was aimed to develop a valid and reliable questionnaire in Bahasa Malaysia assessing the knowledge (K), attitude (A) and practice (P) among the health care providers pertaining to patient's management during flood disaster in Malaysia, known as FloodDMQ-BM. A good questionnaire can be adapted to any cultures, different places and times and yet raising similar results. A series of validation steps in this study such as face validation, content validation and construct validation is to ensure that FloodDMQ-BM is well validated before it can be applied to the target group (Streiner& Norman, 2008). Until now there is no data published on the psychometric characteristics of a KAP questionnaire measuring KAP of healthcare providers managing patients during flood disaster in Malaysia. This study provides evidence of validity and reliability of FloodDMQ-BM so that it can be utilized as an instrument to assess the KAP of healthcare providers involved in flood disaster management in Malaysia.

## **2.0 Materials and Methods**

This study consisted of two phases, which were questionnaire development and psychometric assessment. The questionnaire development consisted of generation of questionnaire items, content validation and face validation. The psychometric assessment involves Exploratory Factor Analysis (EFA) and Item Response Theory (IRT) analysis.

Expert panels comprising of five consultants of Emergency Medicine who were experts in the field of disaster medical management and who were faculties of Universiti Sains Malaysia (USM), Kota Bharu, Malaysia, were tasked to develop items based on four issue domains (1) communication (2) transportation (3) standard operating procedure (SOP) and (4) alert system.

The items generation were partly based on the results of a qualitative study involving various agencies involved in patient management during flood disaster in Kelantan (Tuan Kamauzaman et al, 2015) as well as various local response guidelines of flood disaster (Baharudin et al, 2015). The questionnaire was written in Bahasa Malaysia language as it is the national language of Malaysia and well understood by all healthcare providers in Malaysia. There were four sections to the questionnaire (1) demographic data (2) knowledge (3) attitude and (4) practice where each section of the knowledge, attitude and practice contained items reflecting all four issue domains.

Four lecturers from Emergency Department USM and one lecturer from Unit of Biostatistics and Research Methodology USM formed a committee to validate the content of FloodDMQ-BM. They were selected based on their expertise in the field of disaster which is a requirement of a content validation (Harkness, 2003). The content validation was more of a qualitative judgment than that of a quantitative measurement (Crocker & Algina, 1986). They were contacted through emails and any improvement and suggestions were replied back to the investigator.

Subsequently, face validation of the FloodDMQ-BM was carried out by pretesting to verify the applicability and to evaluate user understanding of the questionnaire (Parsian & Dunning, 2009; Nevo, 1985; Shuttleworth, 2009; Guillemain, 1993). 30 respondents consisted of medical doctors working in Emergency Department Hospital Universiti Sains Malaysia (EDHUSM) were selected via convenience sampling. The sample size was considered adequate for the purpose (Perneger et al., 2014). The respondents were given adequate time to read the questionnaire before undergoing cognitive interview by the researcher. They were asked if they understand the items and if they could repeat it in their own words. Suggestions of alternative phrases used in the items were also recorded. If there were few phrases suggested to replace a word, they were asked to choose the most appropriate phrase that conforms best to their usual usage. The committee then verified these changes before any final changes made.

Construct validation was subsequently done to measure underlying hypothetical concepts of the questionnaire (Trochim & Donelli, 2008). The respondents were staffs at EDHUSM recruited by convenience sampling. The sampling method was used due to limited number of medical officers at the department and to maximize the sample size as required by the analysis. A total of 150 staffs involved in patient management during flood disaster consented to participate in the study. The sampling size met the recommended sample size of ten subjects per item or at least 100 participants (Costello & Osborne, 2005; Hair & Anderson, 1998). They were asked to answer the questionnaire and the researcher was available at all times to clarify any phrases or terms.

Data management and statistical analysis were done using software IBM SPSS version 22.0 for validating all items in attitude and practice section via EFA and internal consistency assessed by Cronbach's alpha. EFA and internal consistency were carried out separately for all items in each attitude and practice section. Kaiser Meyer Olkin (KMO) measure of sampling adequacy with a cut-off point of  $>0.7$  (Costello & Osborne, 2005; Hair et al., 1988) and Bartlett's test of sphericity with  $p$ -value  $< 0.05$  (Hair et al., 1988; Leech et al., 2005) were used to determine suitability of the data for EFA. Eigenvalue  $>1.0$  and visual inspection of scree plot were used to determine the number of factors. Principal axis factoring method was used to extract the factors. Cronbach's alpha coefficient value tested the internal consistency. A value of  $\geq 0.7$  is considered adequate

internal consistency. The knowledge dichotomous response items were analysed by 2-parameter logistic (2PL) model of IRT using *ltm* package in R software.

## **3.0 Result**

### ***3.1 Questionnaire development and content validation***

A total of 36 items were generated for the questionnaire. The knowledge section, containing 12 items was scored on “true” (*betul*), “false” (*salah*) and “don’t know” (*tidak tahu*) options. One point was given for a correct answer and a zero-point given to an incorrect or “don’t know” answer. Thus, the possible score of this section ranged from 0 to 12. The attitude part contained 12 questions and rated on 5-point Likert scale. Points were given on ascending order as following: 1=“strongly disagree” (*sangat tidak setuju*), 2=“disagree”(*tidak setuju*), 3=“neutral” (*netral*), 4=“agree” (*setuju*) and 5=“strongly agree” (*sangat setuju*). The practice part contained of 12 questions and rated on a 5-point Likert scale. Points were given on ascending order as following: 1= “never” (*tidak pernah*), 2= “seldom” (*jarang*), 3= “sometimes” (*kadang-kadang*), 4= “often” (*kebanyakan masa*) and 5= “always” (*selalu*).

In this study, all of the items were acknowledged by experts, resembling the intended construct and hypotheses. No major amendment was done in all items. However, one item under domain transportation in attitude section was divided into items A2 and A3 after being reviewed by the experts. The initial item had two intended questions in a sentence, so the decision to split the item was to avoid ambiguity and misinterpretation (Streiner and Norman, 2008). Therefore, the total items in the attitude section increased from 12 items to 13 items and the total items in FloodDMQ-BM increased from 36 to 37 items

### ***3.2 Face validation***

The pretesting to assess the face validation took approximately 20 to 30 minutes for each respondent. During the cognitive interview, the respondents suggested some improvement in choices of word and length of sentences, as it was too lengthy and at times too technical. The suggestions were highlighted and reviewed by experts and improvements were done accordingly. The changes include terms such as “medical assistant” (*pembantu perubatan*) into “assistant medical officer” (*penolong pegawai perubatan*) and “about” (*mengenai*) into “regarding” (*tentang*) to conform to the local usage. The items in the knowledge sections were retained even some respondents claimed that they were difficult. The experts opined that no alternative terms could be used and such terms were commonly applied in local disaster respond procedures such as, “Government Interagency Radio Network (GIRN)”, “Medical Emergency Coordinating Center (MECC)” and “Amber stage” (*tahap Amaran Amber*).

### 3.2 Construct validation

**Table 1:** Socio-demographic characteristics of construct validation repondents (n=131)

Variables		Mean (SD)	Frequency (%)
Gender	Male		65 (49.6)
	Female		66 (50.4)
Age	20-25	32.12 (7.507)	22 (16.9)
	26-30		38 (29.2)
	31-35		44 (33.8)
	36-40		9 (6.9)
	≥41		17 (13.1)
Ethnics	Malay		114 (87.7)
	Chinese		13 (10.0)
	Indian		3 (2.3)
Place of working	University Hospital		131 (100.0)
Working experience	≤ 5 years	8.4 (7.02)	32 (25.8)
	5-10 years		61 (49.2)
	10-15 years		14 (11.3)
	≥ 15 years		17 (13.7)
Profession	Administrator		2 (1.5)
	Doctor		57 (43.5)
	Nurse		32 (24.4)
	Medical assistant		13 (9.9)
	Support staff		17 (13.0)
	Driver Others		4 (3.1) 6 (4.6)

Table 1 shows the socio-demographic profile of the respondents. Out of 150 questionnaires distributed, 131 applicants responded to this study yielding an 87% response rate. In total, the missing data rate ranged from 0% to 0.07% for all sections and these data were excluded from the study. Recoding was done for the scale of the attitude section: 1=“strongly disagree” (*sangat tidak setuju*), 2=“agree” (*setuju*) and 3=“strongly agree” (*sangat setuju*). The scale for practice was also recoded into: 1= “never” (*tidak pernah*), 2= “seldom” (*jarang*), 3= “often” (*kebanyakan masa*) and 4= “always” (*selalu*). The purpose of recoding was because some coding has got very low respond rate or nil respond thus eliminating the extreme responses as suggested by Grandy (1996).



### 3.3 Exploratory Factor Analysis and Internal Consistency Reliability

**Table 2:** Result of factor analysis and reliability analysis of attitude and practice sections of FloodDMQ-BM

Factor	Items	Factor Loading	Cronbach's alpha
Attitude	A1	0.646	0.925
	A2	0.756	
	A3	0.709	
	A4	0.735	
	A5	0.742	
	A6	0.710	
	A7	0.757	
	A8	0.753	
	A9	0.522	
	A10	0.638	
	A11	0.743	
	A12	0.768	
	A13	0.760	
Practice	P1	0.731	0.935
	P2	0.608	
	P3	0.722	
	P4	0.769	
	P5	0.815	
	P6	0.653	
	P7	0.858	
	P8	0.656	
	P9	0.835	
	P10	0.682	
	P11	0.855	
	P12	0.687	

Extraction method: Principal axis factoring

Table 2 shows the result of factor analysis and reliability analysis of attitude and practice sections. For attitude section, the data matrix was factorable and assumptions to conduct EFA were met as indicated by a KMO value of 0.886 and Bartlett's test of sphericity being significant ( $P < 0.005$ ). Based on eigenvalue value of 7.1, observation of scree plot and cumulative percentage of variance of 54.6%, only one factor determined. All the items in the attitude section had factor loading of more than 0.5 and were retained. The internal consistency via Cronbach's alpha coefficient was 0.925. For the practice section, the data matrix was factorable and assumptions to conduct EFA were also met as indicated by KMO value of 0.925 and Bartlett's test of sphericity being significant ( $P < 0.005$ ). Based on eigenvalue value of 7.063, observation of scree plot and cumulative percentage of variance of 58.85%, only one factor determined. All 12 items in practice section had factor loading of more than 0.5 and were retained. The internal consistency via Cronbach's alpha coefficient was 0.935.

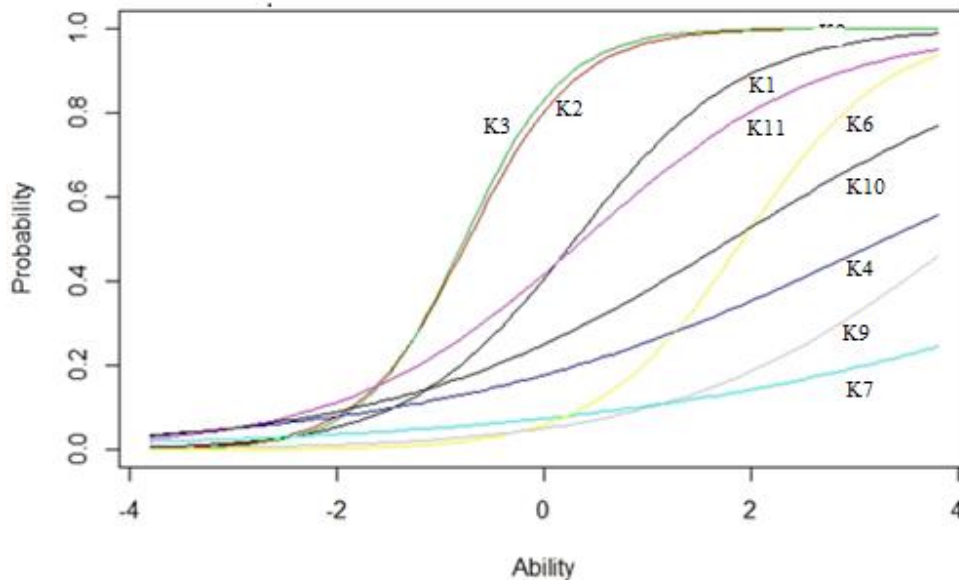
### 3.4 Item Response Theory analysis

**Table 3:** Item Response Theory parameters estimate of items of the knowledge section of the FloodDMQ-BM

Item after removal	Item parameters			S- X2 fit index		
	Difficulty (SE)	Discrimination (SE)	Standardized loading	X2	df	P
K1	0.30 (0.20)	1.24(0.50)	0.78	6.9689	2	0.0307
K2	-0.73(0.21)	1.92(0.78)	0.89	1.1329	2	0.5675
K3	-0.77(0.20)	2.07(0.78)	0.90	10.7892	2	0.0045
K4	3.30(2.32)	0.46(0.34)	0.42	3.2992	3	0.3477
K6	1.93(0.73)	1.43(0.85)	0.82	6.3548	2	0.1702
K7	6.88(8.10)	0.37(0.45)	0.34	6.7194	3	0.0814
K9	4.03(2.71)	0.73(0.56)	0.59	0.5879	2	0.7453
K10	1.82(0.94)	0.60(0.33)	0.52	2.0620	3	0.5596
K11	0.38(0.26)	0.86(0.34)	0.65	6.3548	3	0.0956

RMSEA = 0.086, M2=52.67, TLI=0.62, CFI=0.72

Abbreviations: S- X2=Standardized X2, RMSEA =Root Mean Square Error of Approximation, TLI=Tucker-Lewis Index, CFI= Comparative Fit Index



**Figure 1:** Item characteristics curve for items of knowledge section of FloodDMQ-BM after removal of items K5, K8 and K12 (n=9)

Based on 2PL model using IRT assessment of the knowledge section, item K5 and item K12 had a negative discrimination estimate of -0.04 and -0.13 respectively while item K8 had an extreme difficulty estimate of 91.48. These items were subsequently removed. The IRT analysis of the remaining items is summarised in Table 3. Item K7 had a high difficulty estimate of 6.88 and low standardized loading value of 0.34 but was retained as it was important to assess knowledge. Two-way marginal fit for the finalized items in knowledge section had residues less than four

and considered a good fit at 5% significant level (Bartholomew et al., 2008) The overall model data fit was adequate with a Root Mean Square Error of Approximation (RMSEA) value of 0.086 as suggested by Kenny & Kaniskan (2014) and statistically non-significant of S-X2 as suggested by Orlando & Thissen (2003). All of the items had good standardized loading ranging from 0.3 to 0.9 and marginal reliability of 0.623 as suggested by Dimitrov (2003). There are finally 9 items retained in the final model of the knowledge section. Figure 1 shows the final Item Characteristic Curve of items in knowledge section of the FloodDMQ-BM.

### 3.5 Final model of FloodDMQ-BM

**Table 4:** Summary of FloodDMQ-BM items in all sections before and after psychometric analyses

Section	Before		After	
	Domain	Item	Domain	Item
Attitude	Alert system	3(A9, A10, A13)	Attitude	13(A1-A12)
	Communication	3(A1, A4, A11)		
	SOP	3(A5, A7, A12)		
	Transportation	4(A2, A3, A6, A8)		
Practice	Alert system	3(P5, P10, P12)	Practice	12(P1-P12)
	Communication	3(P1, P8, P11)		
	SOP	3(P4, P7, P9)		
	Transportation	3(P2, P3, P6)		
Knowledge	Alert system	3(K9, K11, K12)	Knowledge	9(K1, K2, K3, K4, K6, K7, K9, K10, K11)
	Communication	3(K1, K2, K3)		
	SOP	3(K7, K8, K10)		
	Transportation	3(K4, K5, K6)		

Table 4 summarizes the items in all sections of the Flood DMQ-BM before and after psychometric analysis. The final model of the knowledge section of FloodDMQ-BM has a total of nine items. This amounts to a minimum score of 0 point and a possible maximum score of none points. Knowledge section with higher score indicates better knowledge of the healthcare provider. A total of 13 items were retained in the attitude section of the FloodDMQ-BM. Items will be rated on a 4-point scale although it was initially recoded into a 3-point scale to satisfy a polytomous scale of at least a 4-point scale (Streiner & Norman, 2008). Attitude on patient management during flood disaster can be evaluated by total score. The possible minimum score of this section is 13 points and possible maximum score is 52. All items were positively structured therefore reverse scoring does not apply to the attitude section. A higher total score in this section indicates a more positive attitude of the healthcare providers towards patient management during a flood disaster. A total of 12 items in the practise section that fit in the FloodDMQ-BM were retained. Total practice score can assess practice of good patient management during flood disaster. The possible minimum scoring is 12 and the possible maximum score is 48. All items were positively structured therefore reverse scoring does not apply to the attitude section. A higher total score in this section indicates a better practice of the healthcare providers regarding patient management during a flood disaster.

## 4.0 Discussion

The FloodDMQ-BM is able to serve as a useful tool as it has been designed and tailored to the healthcare providers providing patient care during flood disaster. In addition, the validity and reliability has been tested. This includes content validation by expert panel, face validation by healthcare providers of similar characteristics as the intended target group, construct validity using EFA and IRT and internal consistency reliability. For content validation, consensus was met in reviewing the FloodDMQ-BM based on the contents of the flood disaster response protocol. In the determination of face validation, comprehensibility of questions by the target group is vital, especially for instruments designed for specific population. Majority of the items designed in the FloodDMQ-BM were well understood by the healthcare providers with exception on certain terminologies, which were later revised to serve the purpose. It may be attributed to the nature of FloodDMQ-BM, which was developed based on patient management by healthcare providers during a flood disaster as well as Bahasa Malaysia language being the national language medium.

The polytomous scale items of attitude and practice sections were validated using EFA while the dichotomous scale items in the knowledge section used IRT. The EFA is essential to search the latent constructs of the items and thereby allowing some theory to be formulated. Using EFA, common factors can be extracted from the list of the items and the relationship among them can be determined. After regrouping, naming of the extracted factor is essential to reduce the variable complexity for greater simplicity. “Attitude” and “practice” are the renamed factors in the attitude and practise sections respectively after extraction replacing “communication”, “alert”, “SOP” and “transportation” factors. All the items in each section of attitude and practice share the same latent construct, which are named “attitude” and “practice” respectively. The decision to choose only 1 factor for each section was to minimize items overlapping and to obtain better factor loading. Finally, it will benefit the outcome of the questionnaire, which is having good validity and reliability. Based on the EFA results, both attitude and practice sections had good construct validation and reliability.

Some items need to be removed from the knowledge section of FloodDMQ-BM in view of poor discrimination parameter such as item K5 and K12. In effect, item K5 and item K12 in poor knowledge respondents will have higher result as compared to good knowledge respondents. Good items such as item K1, K2, K3 and K6 will be able to differentiate between good and poor knowledge respondents.

The conventional way to interpret reliability using Cronbach’s alpha is not meaningful in IRT analysis of the knowledge items because of its dichotomous type of questions as compared to polytomous type of attitude and practice sections (Stoop, 2011). The marginal reliability can estimate the average reliability among the respondent’s knowledge (Thissen, 1986). The exact value of acceptable marginal reliability is not well documented but we based our statistical analysis on studies by Domitrov (2003) and Stoop (2011) that suggested a value of 0.623 being acceptable. Another point to note is that marginal reliability will be influenced by reduction of some items (Stoop, 2011). In this study, the removal of few items that had extreme results such as items K5, K8 and K12 had significantly improved the marginal reliability score of knowledge items.

The item's model fit had good RMSEA and non-significant M2 (Kenny & Kaniskan, 2014). We noted that both the CFI and TLI were 0.6 and 0.7 respectively. Acceptable CFI and TLI values should be more than 0.9 (Hooper et al., 2008). However, in view of good RMSEA result (less than 0.1), the CFI and TLI values can be ignored (Kenny, 2014).

The results of this self-report questionnaire will hopefully generate understanding on the KAP of healthcare providers and highlight knowledge gaps as well as identifying potentials and capabilities for improved health service resilience. It can also serve as an indicator of intervention effectiveness put in place to mitigate risks of flood disaster in health care systems. This limitation of this study was in the sample size. IRT requires a sample size for at least 200 (Kenny, 2014). However, in this study, the sample size was only 131 due to availability of healthcare providers willing to spend time completing the questionnaire.

## **5.0 Conclusion and recommendation**

The FloodDMQ-BM has shown to have good psychometric properties. It is a valid and reliable instrument to evaluate knowledge, attitude and practice of health care provider regarding patient's management during flood disaster. In the future, the suggestion is to recruit more samples so that the IRT components, standard loading and marginal reliability will be improved. The other limitation of this study was it is only confined to the health care provider in Hospital USM, which is a tertiary hospital. Therefore, multi-centre validation study involves the government hospital and local clinic should be conducted in the future to determine the validity and reliability of the FloodDMQ-BM onto a wider population. We would also like to suggest future study to be conducted to substantiate the theory generated by this EFA result by confirmatory factor analysis.

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## **Declaration**

Authors declare that there was no conflict of interest in this study.

## **Authors contribution**

Author 1: data collection, Author 2: manuscript writing, Author 3:

Author 4: statistical analysis and Author 5: data interpretation and discussion

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