

# Development and Validation of a Survey Instrument on Drowning Prevention and Water Safety among Parents of Primary School Children

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## ABSTRACT

**Introduction:** Malaysia has limited educational material on drowning prevention and water safety. Currently, no formal regulations or acts applicable to drowning prevention were identified such as requiring lifeguards to be present in all public pools, pool fencing and wearing floatation devices for children when engaging in water activities. Limited awareness messages are available on drowning prevention, especially for parents. Assessment of parental knowledge, attitude and practice on childhood drowning and its preventive measures will assist in designing essential educational package for childhood drowning prevention and water safety.

**Aim:** To design and evaluate the survey instrument examining knowledge, attitude and practice on drowning prevention and water safety among parents and guardians of primary school children.

**Materials and Methods:** Prior to designing the questionnaire, documents analysis and literature reviewed were employed to provide an insight into the research topic. Six experts evaluated content validity with the score of Content Validity Index (CVI).

The questionnaire was designed and cross-sectional study was conducted among 130 parents/guardians of primary school children in Selangor, Malaysia. Construct validity was estimated using Exploratory Factor Analysis (EFA); utilising principal components method and varimax rotation. The reliability of the questionnaire was evaluated by face validity and Cronbach's alpha respectively.

**Results:** An agreement obtained from the panel experts on the adequacy of the instrument; based on the I-CVI score  $\geq 0.83$  and scale-level content validity (S-CVI/Ave) characteristics of relevancy, clarity, simplicity and unambiguity of each item in the questionnaire  $\geq 90\%$ . Exploratory factor analysis resulted in 10 factor-solutions (69.4% total variance) constructed for attitude domain whereas nine factor-solutions (65.8% total variance) emerged for practice domain. The reliability for knowledge was KR20=0.58 whereas internal consistency using Cronbach's alpha for attitude and practice was 0.81 and 0.84.

**Conclusion:** The drowning prevention and water safety questionnaire developed is useful and reliable for quantifying parental knowledge, attitude and practice characteristic related to water safety and drowning prevention for their children.

**Keywords:** Attitude, Content validity, Knowledge, Practice, Questionnaire development

## INTRODUCTION

The magnitude of drowning phenomenon among children is a well-recognised global public health issue and it has been recorded that the vast majority (97%) of drowning occurs in low and middle-income countries, prevalently related to daily activities [1]. In the case of Malaysia, drowning is reported as one of the top five leading causes of death among children [2]. High fatality and morbidity rates of children due to drowning have prompted growing concern among the public in this country. Therefore, this alarming issue warrants immediate attention and intervention.

Many studies have identified that parental supervision is the most effective, low cost and socially acceptable drowning prevention [3-6], in addition to increased supervision and swimming lesson as the protective strategies [6]. On top of that, a study from Australia also indicated that learning Cardiopulmonary Resuscitation (CPR) has significantly improved the knowledge and confidence among parents [7]. The assessment of Knowledge, Attitude and Practice (KAP) has resulted in the maximisation of drowning protection among parents and guardians by addressing the parental misconceptions of children's water safety; this subsequently leads to positive behaviour and perception about water safety and many more [8-11]. In addition, the employment of survey as a methodology is found to be useful in providing information to identify the general public's needs and problems as well as possible barriers to developing and implementing an intervention [12]. This technique

can also assist researchers in acquiring information to construct a set of recommendations as a guideline for the development of effective drowning prevention and water safety education resources for parents and guardians [13].

Questionnaires about knowledge, attitudes and practices are commonly used in healthcare studies, focussing on various settings and target groups [14-18]. In measuring KAP, the survey instrument must be reliable and valid to reduce the measurement error [19]. Additionally, a reliable and valid evaluation resulted from the use of an appropriate instrument will enhance the data quality that subsequently serves as a good basis for the next step in research [19,20]. This study aims to design, develop and validate a version of a questionnaire to investigate the knowledge, attitude and practice of water safety and drowning prevention among parents and/or guardians of primary school children specifically in a local community in Selangor, Malaysia. In addition, the following assessment of KAP will aid in developing and evaluating the effectiveness of the intervention programme.

## MATERIALS AND METHODS

### Study Design

A cross-sectional study was carried out in order to develop and explore the validity and reliability of the questionnaire on knowledge, attitude and practice of drowning prevention and water safety among primary school children's parents/guardians in Selangor, Malaysia.

Ethical approval was obtained from the University Research Ethics Committee (PPI/111/8/JEP-2016-594). With regards to acquiring the consultation and opinions from the panel experts, the professionals were given the following materials for evaluation: an invitation letter, informed consent form, and a folder with the questionnaire. Based on their personal willingness, participants took part in this study to be the respondents by completing the informed consent forms that were distributed to each one of them.

### Phase I- Development of the Questionnaire

Documents analyses and literature review were conducted to gain a thorough understanding of the views and ideas relevant to the topic, as well as to figure out the items of KAP of drowning prevention and water safety in the instrument. A comprehensive search of existing literature was done through a journal database by searching several keywords related to the research topic, such as “drowning”, “drowning awareness”, “water safety”, “drowning prevention”, “water safety awareness”, “KAP towards drowning” and “Health Belief Model (HBM) on drowning”. The search returned a considerable number of articles (abstract) in the first instance (N=12,810), and the process of extracting relevant articles were subsequently conducted based on several exclusion criteria, namely publication years (only articles published in 2006-2016 were reviewed), languages other than English, and no access or eligibility of full-text articles. After a detailed assessment was performed, eight articles [7,12,21-26] were finally selected as the guide in designing the questionnaire's construct. Additionally, existing documents related to drowning in Malaysia such as reports, statistical data, guidelines and books were analysed in identifying the factors associated with the issues of water safety and drowning prevention [27-29]. Parents/guardians were selected based on convenience sampling and they were required to share their understanding about the general concepts or specific terminologies related to the topic and how they perceive the questions in terms of sensitivity or difficulty. The informants varied in gender, age, place of residence, and occupation.

The overall information from the literature, documents analyses, and parents/guardians' opinions were gathered to develop a preliminary framework for characterising main domains and detailing the items of the KAP survey. The assumption of HBM was used as a base for the theoretical framework upon which the instrument was developed. It has been extensively demonstrated that HBM framework is applicable in developing an instrument and intervention messaging in injury prevention [30-32]. The initial draft of the questionnaire comprised of the socio-demographic section with 19 items (children's swimming activity and swimming ability questions in an open-ended format), knowledge domain with 35 items, attitude domain with 28 items and practice domain with 34 items. The items in the knowledge domain were designed to identify the parents'/guardians' level of knowledge related to drowning risk, drowning prevention, water safety, first-aid and CPR skills.

### Phase II- Validation of the Instrument

**Content validity:** In the second phase, content validation of the developed questionnaire was done through the process of critical reviews and assessment of CVI. The questionnaire's draft was critically examined by the supervisory committee to confirm the content of the questionnaire. The supervisory committee consists of academicians with expertise in public health for >10 years. The comments and suggestions from the supervisory committee were applied in designing the questionnaire, culturally appropriate for the target group.

With regards to the content validity, six experts of the professional team comprising of public health lecturers, clinicians, and professional swimming instructors were appointed to review and confirm the content validity of the developed questionnaire. Approaches of CVI i.e., item level (I-CVI) and scale level (S-CVI/

Ave) were employed to validate the content of the tool [33,34]. Each questionnaire was reviewed individually, followed by the experts' rating on the content based on four characteristics, namely relevance, clarity, simplicity and ambiguity. The Likert's scale was used with four scoring systems of 1 to 4 (1=not relevant, 2=item needs some revision, 3=relevant but needs minor revision, and 4=very relevant). The content validity of the questionnaire was then determined as a proportion of items, and Scale level (S-CVI/Ave) subsequently described as an average proportion or agreement of the item on the scale scored 3 or 4 by experts. As suggested by a previous study, for panel experts more than 5, the I-CVI less than 0.78 should be revised or deleted [33]. As for the Scale level (S-CVI), the score was considered excellent for value >0.9 [33].

**Construct validation:** A cross-sectional study was conducted among 130 parents/guardians in one randomly selected primary school in Selangor to examine the construct validity of the questionnaire on KAP of drowning prevention and water safety. An exploratory factor analysis was conducted (for attitude and practice items) using the principal component method and varimax rotation was applied to determine whether the questionnaire was presented in a multidimensional structure or simple structure [35,36]. The recommended sample size for factor analyses was a range of absolute number from 100 to >1000 or a minimum of 3 to 20 times the figure of the variables [36]. A total set of 156 questionnaires were distributed to the primary school children's parents/guardians with 130 responses (83.3%) asserting their willingness to participate in the study.

As for the knowledge domain, the items were calculated in terms of item difficulty and item discrimination. The item difficulty index presented the percentage of respondents who answer an item correctly. It should be noted that the smaller percentage value of difficulty index indicated a higher level of difficulty [37].

**Face validity:** Face validity was conducted among fifteen randomly selected parents/guardians (who were not involved in the cross-sectional study) to verify the developed questionnaire materialise in terms of their appropriateness relating to the general formatting, clarity of the language used, readability, and feasibility [38,39]. Based on the assessment and comments obtained from the process of face validation, the items in the questionnaire were either edited, removed or unchanged.

**Reliability:** The Kuder-Richardson Formula (KR-20) was the formula used to measure internal consistency for a dichotomous choice of the items [40]. Therefore, item reliability in the knowledge domain was explained by KR-20 and other items in attitude and practice domains were determined by Cronbach's alpha value [20,41,42].

## STATISTICAL ANALYSIS

Several analyses approach is involved in this phase. For the face validity and content validity, the analysis of the result was used percentages and CVI. The calculation of CVI was included I-CVI and S-CVI. For the construct validation of the questionnaire, the analysis of numerical used Statistical Packages for the Social Sciences (SPSS, version 22.0) for Exploratory Factor Analysis (EFA), internal consistency (Cronbach Alpha) and the relationship of domains (Pearson's correlation). Collected data were managed, checked and cleaned with the removal of any subjects with greater than 10% of the necessary data elements missing or any impossible values.

## RESULTS

### Development of an Instrument

Application of the Health Belief Model (HBM) to the construction items of the questionnaire on drowning prevention and water safety context are presented in [Table/Fig-1]. The exploration of parents/guardians knowledge and activities in the context of drowning risk, drowning prevention strategies, drowning awareness, water safety

skill, competencies, and barriers were utilising the conceptualisation of the HBM.

HBM construct	Drowning prevention and water safety context	Example of items in the questionnaire
Perceived susceptibility	Drowning concern	<ul style="list-style-type: none"> <li>Drowning is one of the unintentionally injury leading causes of death among children in Malaysia</li> <li>Boys are more prone to drown than girls</li> <li>All children are exposed to the risk of drowning</li> </ul>
Perceived severity	Preventive awareness	<ul style="list-style-type: none"> <li>Drowning risk is higher in children who cannot swim</li> <li>Children who survived in nearly drown incidents need to be send to hospital for further check-up by physician</li> </ul>
Perceived benefits	Preventive actions	<ul style="list-style-type: none"> <li>Wearing a life-jacket can reduce the risk of drowning in children</li> <li>Swimming skill will reduce the risk of drowning</li> </ul>
Perceived barriers	Barriers in developing skill	<ul style="list-style-type: none"> <li>Unaffordable to attend CPR courses</li> </ul>
Cues to action	Information sources	<ul style="list-style-type: none"> <li>Red flag in coastal areas indicate sea conditions unsafe for all activities for visitors</li> <li>All rules, sign and notices for swimmers need to be observed, read and obey by all including children</li> </ul>
Self-efficacy	Ability to take the recommended prevention behavior	<ul style="list-style-type: none"> <li>I'll make sure my child accompanied by adult all the time while in pool area</li> <li>I can perform a CPR to save my child life during an emergency</li> <li>I emptied a bucket after used and placed in a closed room</li> </ul>

[Table/Fig-1]: Health Belief Model application to construct a set of questions.

The draft of the instrument-KAP questionnaire on drowning prevention and water safety was structured in five sections; socio-demographic section, children's swimming activity and ability section and three domains; knowledge, attitude and practice as detailed in [Table/Fig-2]. The items in knowledge domain have three selection of answers; "Yes", "No" and "Not Sure" which correct answer received one point, incorrect and "Not Sure" answers received zero points. The possible scores for knowledge domain ranged from 0 to 35. Attitude domain consists of 28 items using five points Likert's

Parts/Section	Description	Number of items
Demographic information	The relationship with children, age, gender, ethnicity, education level, working status, marital status, number of children, household income (monthly), place of residence etc.,	22
Children's swimming activity and ability	Parents/guardians self-reported on the frequency of children's swimming activity, swimming lesson, swimming ability, near drowning experience, places for swimming activity, etc.,	Open-ended format
Knowledge	The capacity to acquire, retain and use the information; a mixture of comprehension, experience, discernment and skill of parents/guardians on drowning risk, drowning preventive measure and water safety.	35
Attitude	Acquired characteristic of parents/guardians on their knowledge, beliefs, emotions and values on drowning risk, drowning prevention and water safety.	28
Practice	The application of rules and knowledge on drowning risk, drowning prevention and water safety of parents/guardians that leads to action.	35

[Table/Fig-2]: Description of the questionnaire and number of item.

scale. The scoring systems of "Strongly Agree", "Agree", "Not Sure", "Disagree" and "Strongly Disagree" with numerical scores 5, 4, 3, 2 and 1 will be given to each answer respectively which respondent can indicate their degree of agreement towards the statement given. The possible scores for attitude domain ranged from 28 to 140, and this will determine the respondent's opinion and belief about drowning risk, drowning prevention, awareness and socio-cultural perspectives on water safety. Thirty-five items of the practice domain were hoped to correspond with the respondent's practice towards drowning prevention and water safety such as action is taken to avoid drowning occurrence, especially in risky places. This domain assessed using a four-point Likert's scale of "Always", "Sometimes", "Often" and "Never" category with numerical scores 4, 3, 2 and 1 will be given to each answer respectively, and possible scores ranged from 35-140.

### Validation of the Instrument

**Content validity:** The item CVI (I-CVI) was computed for all items in each domain (knowledge, attitude, practice), respectively using the four parameters; relevance, clarity, simplicity and unambiguity. The agreement of the panel experts on the adequacy of the instrument was obtained; thus items were revised or considered for changes based on the I-CVI score (<0.83). The scale-level content validity (S-CVI/Ave) are shown in [Table/Fig-3]. The characteristics of the content validity were showed high and accepted in the knowledge domain with >90% of relevancy, clarity, simplicity and unambiguity of each item in the questionnaire [41]. However, in the attitude domain, the S-CVI for ambiguity criteria showed a lower score and in the practice domain, a low S-CVI in criteria for relevancy and clarity. Thus the items in the respective domain either were revised or deleted based on the I-CVI score.

Domain	Relevant	Clarity	Simplicity	Unambiguity
Knowledge	0.98	0.98	0.97	0.96
Attitude	0.93	0.94	0.93	0.89
Practice	0.88	0.88	0.90	0.90

[Table/Fig-3]: Scale Content Validity (S-CVI/Ave) of the KAP domains.

**Construct validity (Factor analysis):** A total of 130 (83.3% response rate) parents/guardians of primary school children participated in the study. As shown in [Table/Fig-4], the result obtained responses predominantly from Malay (96.2%), female caregivers (54.6%) with age ranged from 21 to 56 years with mean age was 36.4 ( $\pm 6.657$ ).

Construct validation were conducted for attitude and practice domain. Factor analysis resulted with Kaiser-Meyer-Olkin (KMO) test was 0.771, and Bartlett's test of sphericity was significant ( $\chi^2=1248.72$ ,  $df=378$ ,  $p$ -value <0.001), indicated the adequacy of sample size and items in attitude domain that met the factor analysis requirement. For items in the practice domain, the KMO test was 0.773, and Bartlett's test of sphericity was significant ( $\chi^2=2257.08$ ,  $df=595$ ,  $p$ -value <0.001), also showed an appropriate data for factor analysis. From the factor analysis, 10-factor solutions explained by 69.44% total variance obtained from total 28 items in attitude domain and 9-factor solutions with 65.75% explained total variance from total 35 items in practice domain.

### Item Difficulty and Discrimination

Item analysis was conducted on the knowledge domain, and the items difficulty and items discrimination indexes were calculated. The items difficulty indexes were ranged from 0.02 to 1.00 and items less than 0.2 were revised as it is considered to be difficult [37]. Four items were calculated to have an index less than 0.2, therefore they were reviewed accordingly. Eleven items were having an index of more than 0.9 and were considered very easy items and still be revised in view of their importance and relatedness to the study. Twenty questions in a range of 0.2 to 0.9 were maintained. The items discrimination was ranged from 0 to 1. Item discrimination index with

Demographic characteristic	Number (%)	Mean (SD)
Age (years)		36.4 (±6.657)
Number of children		2.46 (±1.297)
<b>Ethnicity</b>		
Malay	125 (96.1)	
Chinese	3 (2.3)	
Indian	1 (0.8)	
Others	1 (0.8)	
<b>Relationship with children</b>		
Father	23 (17.6)	
Mother	71 (54.6)	
Guardian	18 (13.9)	
Others	18 (13.9)	
<b>Educational level</b>		
No schooling	1 (0.8)	
Primary school	2 (1.5)	
Secondary school	20 (15.4)	
Certificate/Diploma	34 (26.2)	
Degree	50 (38.4)	
Master and above	23 (17.7)	
<b>Occupation</b>		
Not working	4 (3.1)	
Housewife	3 (2.3)	
Self-employed	3 (2.3)	
Government sector	112 (86.1)	
Private sector	4 (3.1)	
Others	4 (3.1)	
<b>Household income</b>		
RM7000 or less	97 (74.6)	
RM7001 and more	33 (25.4)	

**[Table/Fig-4]:** Demographic characteristics of the respondent (N=130).

value of more than 0.2 were maintained and items below the value were revised. Twelve items were found to have a low discrimination index and were revised. The other 23 items were within range of 0.25-1.00 indicated an ordinarily regarded satisfactory for use [37]. The items knowledge domain was considered to have an optimal level of difficulty and able to discriminate performance of good and poor knowledge of the respondent.

**Reliability:** KR-20 reliability coefficient score was 0.58 for knowledge and reliability coefficients (Cronbach's alpha)'s scores were 0.81 and 0.84 for attitude and practice respectively.

**Face validity:** From 15 parents/guardians participated in rating the instrument, 73.3% agreed that the title and objectives of the questionnaire on the front page were easy to understand. About 86.7% of respondents also agreed on the font writing style, the font size and spacing of the text. Majority of the respondents also indicated that the structure and formatting of the questionnaire are appropriate and suitable (83.3%) and easily understandable and relevant (80%).

The mean scores in knowledge, attitude and practice domains are presented in [Table/Fig-5]. The correlation of questionnaire domains showed a positive relationship, moderate in strength and statistically significant [Table/Fig-6].

The final questionnaire consisted of 111 items; with 22 items of respondent's socio-demographic, 32 items in knowledge domain (3 items were edited and shifted to the respondent's background section), 25 items in attitude domain and 32 items in practice domain (with 3 items were deleted in each domain respectively) due to the low CVI score. The children's swimming activity and swimming ability items is made as an open-ended format.

Domain	Mean (SD)	Range
Knowledge	23.82 (±3.12)	16-31
Attitude	117.67 (±10.71)	87-140
Practice	121.72 (±13.23)	55-139

**[Table/Fig-5]:** The mean score in each of knowledge, attitude and practice domains.

Domain	Knowledge	Attitude	Practice	Total
Knowledge	1	**0.350	**0.308	
Attitude	**0.350	1	**0.324	
Practice	**0.308	**0.324	1	
Total				1

**[Table/Fig-6]:** Pearson's correlation between knowledge, attitude and practice domains

\*\*correlation is significant at the 0.01 level (2-tailed)

## DISCUSSION

The development of instrument utilised face and content validity processes to establish construct validity in ensuring that the instrument is psychometrically sound. The final questionnaire of knowledge, attitude and practice concerning drowning prevention and water safety has demonstrated adequate construct validity and good internal reliability. The knowledge items were evaluated using item analysis and the present study has found that the knowledge items had the appropriate levels of difficulty and discrimination index as suggested in a previous study [37]. As such, four items displayed a low discrimination index but were subsequently revised, retained, and still considered vital to measure the knowledge of drowning prevention and water safety. This finding is similar to that of other researches that examined the development of instruments; the item analysis was essentially useful to guide the evaluation of each item and reflect only the items' internal consistency and not the items' validity [41,43]. Furthermore, it was found that 12 items displayed low difficulty index, implying that the parents/guardians were lacking in knowledge related to drowning prevention and water safety. As suggested by earlier researcher, these items were also revised and retained in the questionnaire in order to identify the specific topics that justify the need for an education programme that can be targeted to the parents/ guardians [41].

In terms of the content validity, the agreement of the judges on the adequacy of the instrument obtained an average I-CVI value of 0.95, showing a statistically excellent content validity as it has I-CVIs of higher than 0.83 as suggested in a previous study [33]. In comparison with other researchers that performed content validity using CVI on instrument development, present study showed that the items in the questionnaire had high scales of simplicity, relevance, clarity, and unambiguity, comprehensive and representative [14,19,35]. In addition, findings from face validity supported the content validity of the questionnaire and indicate its readability and feasibility. Present study showed similar findings as the previous study on items validity agreement of at least 75% positive responses [43].

With regards to the reliability determination, the value of Cronbach's alpha for attitude and practice domains showed internal consistency of the items in the questionnaire which, therefore, confirmed the adequacy of these scales' of internal consistencies. Nevertheless, the knowledge domain resulted in a low value (KR-20=0.579) which signalled a need for improvement [44]. A single approach to examine the content validity was suggested to be insufficient; thus, a construct validity approach had been tested for the multiple items in the instrument to tackle this issue [34]. In the present study, Bartlett's test of sphericity was found significant, and the KMO test demonstrated the sampling adequacy. The result of exploratory factor analysis displayed that the factor loading for all factors in attitude and practice domains were statistically significant and higher than 0.4 as suggested in most literature [44,45]. Studies have suggested that the value of loading factors provided an overview of how much the variables contributed

to the factor and showed a clear association between the dimensions of attitude and practice respectively [46,47].

In comparison to other studies on instrument development and validation, the present questionnaire was developed to measure knowledge, attitude and practice of drowning prevention and water safety. It has successfully demonstrated good reliability, acceptable in readability and feasibility and high content validity [9, 41, 47, 48]. Therefore, present study managed to develop a valid questionnaire and it is ready to measure KAP drowning prevention and water safety for primary school children's parents/guardians of Malaysia.

## LIMITATION

The limitation of the study was small sample size. Further studies with larger and more diverse samples need to be conducted for scale standardisation in various settings.

## CONCLUSION

Discovering the KAP of drowning prevention and water safety among parents and guardians offers a broad overview of the current awareness pertaining to drowning issues in Malaysia. The present study allows the exploration and a clearer understanding of the parents'/guardians' existing knowledge, skills and practices on drowning prevention and water safety. This method can serve as a suitable format to evaluate public health intervention related to the implementation of water safety recommendations and drowning prevention measures. In a nutshell, the initial assessment of KAP will lead to better planning of health programmes that are designed to raise the awareness about water safety as well as to impart the necessary drowning prevention education and skills among parents and guardians.

In conclusion, the survey instrument employed in this study in examining knowledge, attitude and practice should be useful in screening parents and guardians to determine their understanding and willingness to improve their awareness of drowning prevention and water safety. The psychometrics of the instrument was empirically reliable for internal consistency in addition to the evidence of strong reliability estimates on the three scales across a representative and diverse sample.

## SUPPLEMENTARY MATERIAL

The supplementary material is available at:

[https://jcdr.net/articles/supplementarydata/12817/40100\\_Annexure.pdf](https://jcdr.net/articles/supplementarydata/12817/40100_Annexure.pdf).

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