DEVELOPMENT AND VALIDATION OF A QUESTIONNAIRE ASSESSING THE KNOWLEDGE, ATTITUDE AND PRACTICES TOWARDS MEDICALLY IMPORTANT INSECTS AMONG SCHOOLCHILDREN IN MALAYSIA

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Abstract

Insects can be found in a wide range of habitats, including deep jungles, agricultural plantations and even in our own homes and gardens. There are, however, harmful insects that have been classified as medically important, such as mosquitoes and flies. The goal of this study is to design, develop and validate a questionnaire for measuring primary schoolchildren's knowledge, attitude and practices (KAP) about medically important insects in Malaysia. A mixed method study was employed, and the questionnaire was designed in Phase 1 by reviewing several literature studies. Twenty questionnaire items were face-validated by 24 recognised experts in medical entomology during Phase 2. The construct validity and reliability of the questionnaire were assessed using the exploratory factor analysis (EFA), principal components analysis (PCA) and Cronbach's alpha (α). As a result, the questionnaire's final collection has 16 items in each of their respective domains. With Cronbach's alpha of 0.7, the consistency was found to be acceptable. The developed questionnaire can be used to assess schoolchildren's KAP towards medically important insects, hence increasing the possibility of reaching two Sustainable Development Goals (SDGs), good health and well-being (SDG 3) and quality education (SDG 4).

Keywords: Instrument Validation, Questionnaire Survey, KAP Study, Insects, Schoolchildren

Introduction

Insects can be found in a wide range of habitats, including deep jungles, agricultural plantations and even in our own homes and gardens. Some of them have been reported to live on human bodies (1, 2). The current estimated number of insect species in the world is 10 million, with only about 1.75 million having been described thus far. The human-to-insect ratio is estimated to be 1:1.4 billion. They play critical roles as ecological indicators on earth due to their abundance in various environments such as forests, aquatic sources, and soil (3, 4). In addition, some insects function as plant pollinators, waste recyclers and forensic witnesses (5, 6). However, harmful insects have been classified as medically important, such as mosquitoes and flies (7, 8).

Mosquitoes and flies are important disease transmission vectors. Mosquitoes like *Aedes aegypti*, *Anopheles gambiae* and *Mansonia uniformis* were among the vectors for dengue, malaria and filariasis, respectively (9, 10). Meanwhile, flies such as phlebotomine sand flies are carrying the parasite, *Leishmania* (11). Aside from that, domestic flies like houseflies, flesh flies and blowflies also serve as hosts for a variety of pathogenic bacteria such as Enterococci, *Klebsiella oxytoca*, and *Proteus mirabilis* (12). In Malaysia, there has been an increase (121%) in dengue cases post COVID-19 pandemic especially between year 2021 and 2022 (13, 14). Several factors such as growing global population, unplanned rapid urbanisation, global warming, lack of healthcare facilities, and inefficient mosquito control methods have been associated with increase in dengue transmission (15, 16). As for flies, only one imported case of leishmaniasis from humans was recently reported in Malaysia (17). As a result, there is an urgent need to educate the public about the importance of insects as infectious disease vectors.

Some initiatives to disseminate information to the public were launched, including newspapers, television and radio commercials, social media as well as seminars (18). However, the interest lies in younger children on whether the information related to medically important insects has reached them effectively. This effort aligns with several Sustainable Development Goals (SDGs) highlighted by the United Nations, such as promoting good health and well-being, providing quality education, appreciating life on land, and building partnerships to achieve the goals. Some mosquito-borne diseases, such as malaria were previously classified as neglected tropical diseases (NTDs) (19). Therefore, the goal of good health and education can be achieved with proper information disseminated among schoolchildren, particularly those living in rural areas.

To combat these diseases, youth must be educated on insects and insect-borne diseases. Although insects were included in Malaysian school curricula from standard 4 to 6 (ages 10 to 12 years old), none of the topics addressed the benefits and drawbacks of insects to humans and the environment. The existing curriculum focused on insect classification, general characteristics and physiological processes like leg count, respiration rate and role in food webs (20-22). Thus, increasing children's understanding of insect roles can help them achieve the SDGs for quality education, particularly SDG 4.7, which focuses on education for sustainable development.

Currently, it is impossible to assess schoolchildren's current knowledge, attitude and practices (KAP) towards medically important insects, particularly in Malaysia. This is because no current study attempts to assess schoolchildren's KAP towards insects and their roles in infectious disease transmission. It was also crucial to evaluate the differences between urban and rural schoolchildren's reactions to medically significant insects since Malaysian schools were segregated into distinct urban and rural areas based on locations and access to facilities such as internet connection. We assumed that with proper access to the facilities mentioned, the urban school children will be better equipped with knowledge on medically important insects compared to the rural areas. Therefore, this research aimed to design, develop and validate a questionnaire that can evaluate and compare Malaysian schoolchildren's knowledge, attitude and practices (KAP) in both urban and rural areas on medical important insects.

Materials and Methods

Study sites and participants

The questionnaire was distributed randomly to 80 schoolchildren aged 10 to 12 from both rural and urban communities in Selangor state, Malaysia, to further test the validity and reliability of the items. The schools were categorised according to rural and urban areas by the Ministry of Education Malaysia (MOE). The classifications were based on the location of the school's distance from the city as well as access to facilities such as internet access, teaching tools and others. The age range was chosen based on their exposure to insect knowledge in school-based formal standardised textbooks.

Questionnaire Development

Phase 1 (Qualitative Phase): Item and domain development

Literature review

The flowchart of questionnaire development and validation is shown in Figure 1. The authors prepared the items for a questionnaire based on literature surveys, discussions with experts in the field and guidelines from the Ministry of Health of Malaysia (MOH) about medically important insects. For the literature review, published research was collected using Boolean operators 'And' and 'Or' for keywords such as 'medical important insects', 'mosquitoes' and 'questionnaire on insects' and 'schoolchildren' in several databases in the English language, including Google Scholar, Web of Science and ScienceDirect.

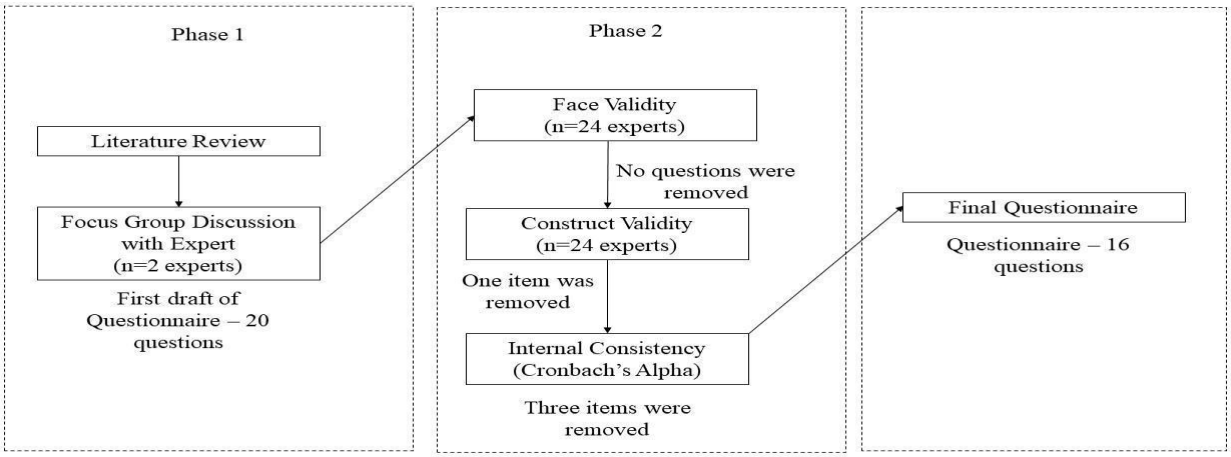

Figure 1: Flowchart for questionnaire development and validation.

Following that, discussions with several medical entomology experts were held to develop a conceptual framework for schoolchildren to understand the medical importance of insects. The experts who took part in the discussion were qualified university professors with extensive experience teaching medical entomology. The discussion reviewed and identified several possible domains, including general information on insects, perception of insects, insect diseases and insect-related actions. In this study, the theoretical and conceptual frameworks developed in these domains were based on Health Belief Models (HBM) with three important model keys highlighted: 'Perceived Susceptibility', 'Perceived Benefits' and 'Self-Efficacy' (23, 24). The term 'Perceived Susceptibility' referred to the fear of contracting a disease, whereas the term 'Perceived Benefits' referred to the advantages of engaging in healthy behaviour (25). Finally, 'Self-Efficacy' denoted belief in one's ability to engage in healthy behaviours that resulted in benefits (26).

Phase 2 (Quantitative Phase): Validity and reliability of the questionnaire

Face validity

The questionnaire items were evaluated by 24 established experts in medical entomology from Malaysian and international universities. Each item was examined and commented on for the level of difficulty for children, as well as the clarity and relevance of the questions. In response to the panellists' feedback, the questions were refined and domains for the questionnaire items were established. The insect questionnaire was identified as QMII (Questionnaire on Medical Important Insects).

Demographic analysis

Demographic data of the participants such as the type of school (urban or rural), the age and gender of students were collected and analysed using descriptive statistics.

Construct validity

Exploratory factor analysis (EFA) using principal component analysis (PCA) and varimax rotation was used to investigate the associations between the set of variables described in the items and to establish the construct validity of the instrument (27, 28). Factor loading (≤ 0.5) and P-values (≤ 0.05) were considered significant. The items that do not fall into any factors were removed.

Reliability of questionnaire

All 19-items (1-item removed in Construct Validity) in the questionnaire were evaluated using reliability analysis to ensure that they were consistently measuring the same characteristics (29). Some of the items were removed from the questionnaire to achieve an acceptable Cronbach's alpha value (≥ 0.7) (30). All statistical analysis in Phase 2 was performed in IBM SPSS Statistics version 26 (IBM, USA).

Results

Demographic characteristics

The average age of the participants was 11.22 (SD = 0.05) years, with 36.3% males and 63.7% females. The survey was completed by 61.2% of students from urban schools and 38.8% from rural schools. The demographic characteristics of the participants are shown in Table 1.

Table 1: Demographic characteristics of participants in the knowledge, attitude, and practices (KAP) to medically important insects' questionnaire in primary school children (n = 80)

Characteristics	Number (n)	Percentage (%)
Gender		
Male	29	36.3
Female	51	63.7
Type of School		
Urban	31	61.2
Rural	49	38.8

Domains of QMII

Three domains were proposed in this study: knowledge, attitude and practices (KAP). Based on the EFA analysis, twenty questions were originally asked and divided into seven components (Table 2). The knowledge domain was designed to test the definition of entomology, basic insect knowledge, the medical importance of insects and insect uses. The second domain, Attitude, assessed schoolchildren's attitudes toward insects. It was designed to assess their understanding of the roles, dangers, and educational value of insects. The final domain, Practices, investigated the behaviour and reactions of schoolchildren to insect-borne disease prevention and management.

Table 2: The domain and components of the medical insect questionnaire of elementary school students

Domains	Dimensions	Items
Knowledge	Definition	1. Definition of entomology
	Basic insect information	2. Identification of insects
		3. The life cycle of insects
		4. The classification of insects
	Medical importance insect	5. Dengue vector
	Significance of insect	6. Insect-related diseases
		7. Insects as pollinators
		8. The uses of insects

Table 2: The domain and components of the medical insect questionnaire of elementary school students (continued)

Domains	Dimensions	Items
Attitude	Perspective towards insects	9. The danger of insects
		10. The elimination of insects
		11. The roles of insects in spreading diseases
		12. The benefit of insects to human
		13. The treatment after exposure to harmful insect
		14. The necessary for insect education
Practices	Prevention of insect-borne disease	15. Prevention from mosquitoes
		16. Prevention from mosquitoes
		17. Prevention from mosquitoes
		18. Prevention from flies
		19. Self-protection against insect bites
	Management of insect infestation	20. Management of contaminated food from flies.

Construct validity of QMII

The EFA analysed all items in the QMII except item-5, item-8 and item-12, which were removed during the Reliability Test. The KMO test revealed moderate sampling adequacy (KMO = 0.659) and Bartlett's confirmed the factor analysis's appropriateness ($p < 0.001$). The EFA extracted seven factors with eigenvalues greater than one. Following the factor analysis, item-4 was removed from the QMII because it did not belong to any of the factors. The EFA was then repeated without the four items that had previously been discarded. Six factors were chosen from a total of 16 components. The factors were identified as "factor 1: prevention of insect breeding", "factor 2: awareness of insect-borne disease", "factor 3: self-protection against insects", "factor 4: general knowledge of insects", "factor 5: insect identification and management of insect bites" and "factor 6: learning insects' education". For all items tested, the communality was greater than 0.20 (Table 3).

Reliability

The QMII's overall consistency was unsatisfactory (Cronbach's $\alpha = 0.570$). Cronbach's alpha values were 0.486, 0.426 and 0.786 for three domains (Knowledge, Attitude and Practices). An additional alpha showed an improvement when item 5 (Cronbach's $\alpha = 0.598$), item 8 (Cronbach's $\alpha = 0.582$) and item 12 (Cronbach's $\alpha = 0.606$) were deleted. Following the factor analysis, component 4 was removed from QMII. After removal, the alpha test showed acceptable consistency (Cronbach's $\alpha = 0.7$).

Table 3: Exploratory factor analysis results of QMII

Domain	Component	EFA Factor loading						Communality	α if the component was removed
		Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6		
Knowledge	**1**	0.062	-0.129	0.051	0.791*	0.017	0.075	0.655	0.555
	2	-0.094	-0.006	-0.022	0.143	0.703*	0.316	0.624	0.541
	3	-0.030	0.234	0.076	0.648*	-0.010	-0.311	0.578	0.555
	6	0.051	0.542*	-0.097	0.292	0.009	-0.111	0.404	0.549
	7	-0.181	0.302	-0.122	0.652*	-0.042	0.134	0.584	0.555
Attitude	**9**	0.046	0.780	-0.138	0.004	0.027	-0.033	0.632	0.536
	10	0.076	0.812*	0.218	0.009	-0.052	-0.002	0.716	0.519
	11	-0.273	0.659*	0.252	0.080	0.282	0.332	0.768	0.513
	13	0.264	0.098	0.089	-0.203	0.735*	-0.236	0.724	0.541
	14	0.285	-0.004	-0.059	-0.004	0.067	0.794*	0.719	0.541
Practices	**15**	0.778*	-0.005	0.188	0.003	0.347	0.035	0.763	0.513
	16	0.748*	0.103	-0.108	-0.012	-0.154	0.085	0.655	0.555
	17	0.672*	-0.140	0.457	-0.052	0.162	0.275	0.624	0.523
	18	-0.034	-0.061	0.900	0.071	-0.076	-0.055	0.578	0.555
	19	0.305	0.168	0.778*	-0.048	0.186	-0.012	0.404	0.511
	20	0.578*	0.034	0.427	-0.158	-0.054	0.446	0.584	0.532
Factor loading > 0.5									

Discussion

Previous studies reported on public opinion on insects, but they did not focus on medically important insects such as mosquitoes and flies or any specific age group (31, 32). As a result, the QMII was designed specifically to assess medically important insects against schoolchildren of specific ages. Originally, it had three major domains (Knowledge, Attitude and Practices), seven dimensions and 20 items. Following the revision, the dimensions were reduced to six factors with 16 items. The KMO demonstrated moderate sampling adequacy (KMO = 0.659), most likely due to the small number of samples collected from only one state in Malaysia (Selangor). However, Bartlett's test confirmed that the factor analysis was correct ($p < 0.001$). In the future, increasing the sample size by conducting the study in more schools may improve the KMO's values.

Some of the extracted factors addressed the three keys highlighted in HBM. In general, HBM was thought to be a good predictor of preventive health behaviours in people of all ages and genders (33, 34). Several studies have shown that adhering to key components of HBM improves disease management behaviour (35-37). In this study, factor 2 was categorised as 'Perceived Susceptibility', indicating that the children were aware of their risk of contracting insect-borne diseases. Factor 5 could be included in 'Perceived Benefits', where schoolchildren saw insect education as having a positive impact on their health protection. Meanwhile, factors 1, 4 and 6 were classified as 'Self-Efficacy', implying that they believed they could perform mosquito and fly prevention activities that would gradually reduce disease spread. Because the schoolchildren were aware of the diseases caused by insects and how to prevent them, these findings demonstrated that Malaysia is making progress towards achieving SDG 3 goal 3.3, which is to promote excellent health and well-being.

Although factor 3 was unrelated to the HBM model, it was necessary to include the items in the factor to assess schoolchildren's general knowledge of insects. This is because understanding general insect knowledge among schoolchildren contributed to SDGs related to education, appreciating life on land and later, it could be later building potential partnerships to achieve previous SDGs with the schoolchildren. The findings of this study on education were consistent with the illustration by Kolb and colleagues in 2017 (38) that elaborated on the impact of Goal 4 on other SDGs. Goal 4 has proven to be a major challenge for all education systems (i.e., primary, secondary, tertiary) (39) and the purpose of this study was to address this goal while indirectly achieving other SDGs.

The Cronbach's $\alpha = 0.672$ indicated that the overall consistency was acceptable; four components (items 4, 5, 8 and 12) were removed following the EFA and alpha test. The communality was greater than 0.20 for all 16 items tested. However, the internal consistency of the two domains (knowledge and attitude) was low. This is most likely due to the small number of questions on the questionnaire (40). The authors, however, decided against adding more questions because they would confuse and overwhelm the children, causing them to lose focus and interest. Furthermore, the internal consistency for the practice domain was acceptable (Cronbach's $\alpha = 0.786$), indicating that the domain's items were well-connected to one another. Overall, EFA and Cronbach's test results showed that the QMII had adequate reliability and validity.

This questionnaire was simple and easy for the schoolchildren to answer. The data collected was also useful in evaluating the knowledge, attitude and practice of primary school children even with a low number of participants. There are several limitations to this study. First, it has a very small sample size ($n = 80$), where only two schools were selected: one urban and one rural. Second, the study was limited to one state of Malaysia (Selangor), which may not be representative of the entire Malaysian population. Third, the age of the schoolchildren in the study ranged from 10 to 12 years old. By increasing the age range, researchers may gain a better understanding of children's attitudes toward medically important insects. Finally, some of the questions did not fall into the same proposed factor after the exploratory factors analysis. To further assess and provide specific factors and clear dimensions in each item in the questionnaire, a refined question should be developed.

A larger sample size will be required in the future to assess Malaysian schoolchildren's attitudes towards medically important insects from both urban and rural areas. This questionnaire should be distributed throughout Malaysia to gain a better understanding of the significance of including additional material in school curricula. The results of the evaluation may be presented to the Ministry of Education (MOE) for further discussion and review. However, because changing the school curriculum could take several years, it was suggested that a specific educational programme involving the introduction of medically important insects be developed to improve the KAP of schoolchildren. Lessons in the programme should be entertaining, interactive and enjoyable for the students.

Conclusion

To the best of our knowledge, this is the first study in Malaysia that examines the importance of insects from the perspective of schoolchildren. Overall, the QMII demonstrated acceptable reliability and moderate validity in assessing the knowledge, attitude and practices (KAP) towards medically important insects in elementary schoolchildren in Malaysia aged 10 to 12 years old. The findings of this study could be used to assess schoolchildren's knowledge, attitude and practices about medically important insects. It was also useful in assessing Malaysia's chances of achieving SDGs such as good health and well-being, quality education and life on land.

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Competing interests

The authors declare that they have no competing interests.

Ethical clearance

The ethics approval (REC/07/2020 (MR/159) was obtained from the Universiti Teknologi MARA Human Ethics Committee.

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