DEVELOPMENT OF A HEALTH PROMOTION QUESTIONNAIRE INDEX (HPQI) TO MEASURE DOKTOR MUDA (JUNIOR DOCTOR) PROGRAMME IMPACT ON SCHOOLCHILDREN'S ORAL HEALTH KNOWLEDGE, ATTITUDES AND BEHAVIOUR

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Original Article

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ABSTRACT

Long term evaluations of impacts of community based health promotion programmes are not an easy or straightforward task to do due to lack of validated and reliable indices. **Objective:** To develop and test an index to measure schoolchildren's oral health knowledge, attitudes, and behaviour as a result of a school-based health promotion programme in Malaysia called the *Doktor Muda* (Junior Doctor) Programme (DMP). **Materials and Methods:** The index was developed in English based on the DMP module and translated into Malay. The Malay version was tested on 174, 11-12 year old schoolchildren. Psychometric analysis of the index involved content and face validity tests as well as factor analysis, internal and test-retest reliability. **Results:** Factor analysis yielded 3 factors with groups of items viz. oral health knowledge (OHK), oral health attitudes (OHA) and oral health behaviour (OHB). The Cronbach's alpha coefficients of the three factors were 0.61, 0.73, and 0.64, respectively. The Kappa coefficients were 0.70, 0.77 and 0.73, respectively (intraclass correlation coefficients = 0.72, 0.70 and 0.78). The final questionnaire comprised 33 items, namely; OHK 11 items, OHA 15 items, and OHB 7 items. **Conclusion:** The Health Promotion Questionnaire Index (HPQI) to measure the DMP impact on schoolchildren's oral health knowledge, attitudes, and behaviours was empirically verified to be valid and reliable for use among 11-12 year old Malaysian schoolchildren.

Keywords
Attitudes, behaviour, *Doktor Muda* Programme, evaluation, Health Promotion Questionnaire Index (HPQI), knowledge, oral health.

INTRODUCTION

Increasing emphasis is now being placed upon the evaluation of health promotion (HP) interventions to demonstrate their impact and long term effect on health (1). Generally, evaluation assesses how a programme has been conducted, what has been achieved, and how it has been achieved (2). It is important to measure success levels, develop good practice, make best use of resources, provide feedback and inform policy development (3).

In Malaysia, a school-based HP programme called the *Doktor Muda* (Junior Doctor) Programme (DMP) was introduced in primary schools in the late 1980s (4). It is a smart partnership programme between the Ministries of Health and Education. DMP is a child-to-child peer-led HP programme where a group of schoolchildren called *Doktor Muda* (DM) or 'young doctors' are empowered to give health education and conduct health related activities at school all year long. They act as an agent of change to promote healthy lifestyles to their peers, families, and the community (5). Following a successful introduction in Pahang and Kelantan states in 1989 and 1991, respectively, DMP was introduced in other states in Malaysia. By 2010, there were 1255 DMP schools with 33,440 trained DM, representing about 20% of primary schoolchildren in Malaysia (6).

Among DM tasks were heading DM Club activities, helping teachers and health personnel, giving health talks during assembly and in 'adopted classroom', distributing health leaflets, preparing scrap books, putting up health posters, organising hand washing exercise, and supervising toothbrushing with fluoride toothpaste. The content of the health talks included topics on personal hygiene, environmental hygiene, oral health, mental health, prevention of disease, safety and injury prevention,

healthy nutrition and diet, healthy lifestyles, and healthy teenagers (5). In 2009, a WHO representative visited one of the DMP schools in Negeri Sembilan which had won the national DMP School Excellence Award in 2008 (7). The purpose of the visit was to witness the DMP activities at school and meet the teachers and the children.

Despite the WHO informal recognition of DMP as a health promoting school model in Malaysia during its representative visit to Malaysia in 2009, no evaluation on DMP has been conducted. As far as oral health was concerned, it was argued whether the DMP had any additional effect on schoolchildren's oral health over and above caused by water fluoridation and school oral health service, especially when caries level among 12-year-olds is declining (8-10). It was also argued whether the cost and time invested by Ministries of Health and Education on DMP for the past two decades has been worthwhile. Thus, it was argued that the DMP effect on health and oral health should be evaluated.

This present study focused on the DMP impact on oral health. It was part of a larger study to evaluate the DMP impact on schoolchildren's oral health knowledge, attitudes, behaviour, oral health status and oral health related quality of life. The study was based on the PRECEDE-PROCEDE health promotion model as the evaluation framework (11). According to the model, the immediate DMP outcomes are changes in health knowledge and attitudes, followed by health behaviour. However, suitable validated indices to measure these changes have never been developed. Given the above, the present study aimed to develop an index, the Health Promotion Questionnaire Index (or HPQI) to measure changes in schoolchildren's oral health knowledge, attitudes, and behaviour as a result of DMP.

MATERIALS AND METHODS

The HPQI was developed based on a standard protocol developed by Acquadro et al in 2004 (12). It consisted of 3 phases; development of the draft questionnaire, followed by linguistic and psychometric validation.

Development of Draft Questionnaire

The questionnaire was drafted in English for use by 11-12 year old schoolchildren. Its content was based on the DMP module (5), Oral Health Promotion Evaluation Tool Kit (13) and the dental literature (14). First, a total of 7 oral health knowledge (OHK) domains were identified from the DMP module. These were dental caries and prevention, gum disease, fluoride, oral hygiene methods, dental visit, benefits of good oral health, and oral health effect of smoking. Next, for each OHK domain, at least one OHK outcome was identified from the DMP module. For example, in dental caries and prevention domain, one of the OHK outcomes was 'sugar causes caries'. Based on the OHK outcomes, the evaluation outcome measures or items of the questionnaire were drafted. Likewise, the items of the other 6 OHK domains were drafted in a similar way.

For Oral Health Attitude (OHA) items, they were drafted based on the OHK items and their impact on oral health attitudes (11). Based on the drafted OHK items, 2 OHA domains were identified to be highly relevant to most of the OHK items; 'attitude towards toothbrushing' and 'attitude towards consumption of sugary food and drinks'. For example, a student with good knowledge on dental caries would tend to have good attitude towards sugary food and drinks intake. For each of the OHA domains, a set of attitude items were drafted.

For Oral Health Behaviour (OHB) items, they were drafted based on the dental literature, and the draft OHK and OHA items. Consequently, the draft OHB items consisted of questions to measure schoolchildren's toothbrushing, fluoride use, mouth rinsing after meal, flossing, soft drinks intake, sweets intake, and smoking frequencies.

Next, the items were arranged into a questionnaire and organised into 3 parts; OHK, OHA, and OHB which consisted of 12, 15, and 7 items, respectively. OHK items used a 5-point rating scale; strongly agree (scale 1) to strongly disagree (scale 5). OHA items used a 4-point rating scale; strongly agree (scale 1) to strongly disagree (scale 4). OHB items used a 7-point rating scale; more than twice daily (scale 1) to never (scale 7). Information on the purpose of the research, answering techniques, and questions on demographic profile were added.

Content Validation of Draft Questionnaire

The draft questionnaire was checked for content validity by 3 dental public health specialists. Content validity refers to the adequacy of the measure to assess the domain of interest, i.e. whether the items were relevant to the topics, the concepts were culturally relevant and acceptable to society, and the items conformed to current scientific knowledge (15). The applicability, efficiency, clarity, and sensitivity of the measure were also assessed (15).

Following content validity assessment, a separate discussion with each of the 3 reviewers was held. The aim was to discuss issues related to content validation including choosing the most appropriate items for each of the domains. Unsuitable, confusing, or redundant items were rephrased or removed. Following the discussions, changes to the draft questionnaire were made. The final questionnaire consisted of 33 items; 11 items, 15 items and 7 items for OHK, OHA and OHB domains, respectively.

Translation of Draft Questionnaire from English into Malay

This process is called linguistic validation and involved 2 stages; a forward translation of the draft English

questionnaire into Malay and a back translation of the draft Malay version into English (12).

The draft questionnaire was translated into Malay by 3 independent translators who were experts in dental public health and proficient in English and Malay language. Then, a meeting with the translators was held to analyse the translated documents paying attention to conceptual and item equivalence between the drafted questionnaire and its Malay version. Conceptual equivalence refers to whether answers to the same questions reflect the same concept. Item equivalence refers to whether equivalence of meaning of the items is maintained throughout the translation (16). Consequently, the group agreed on a single consensus translation.

The draft Malay questionnaire was tested for face validation on a non-random sample of 40, 11–12 year old schoolchildren from a school not involved in the final study. Data collection was conducted by the researcher (ZY) and assisted by the classroom teacher. The time taken to answer the questionnaire was noted. Following the test, a discussion with the schoolchildren was held to discuss their understanding on the purpose, content, wording, instruction, and general structure of the questionnaire. Following the discussion, minor changes to the questionnaire were made.

The next step involved a back translation of the draft Malay questionnaire into English. It was done by an expert translator from Department of Asian and European Languages, University of Malaya who is proficient in English and Malay language. Then, a thorough discussion on the output of the back translation by experts in dental public health and English and Malay language was held, comparing the back translation with the original English version. After minor modifications, the back translation of the draft questionnaire was verified and agreed upon by all parties involved. Small changes to the draft Malay questionnaire were made before it was finalised.

Psychometric Validation of Malay Questionnaire Draft

The Malay questionnaire draft was tested on a non-random sample of 174, 11–12 year old (Year 6) schoolchildren from 2 urban schools in Kuala Lumpur. The 2 schools represented a middle class and lower socioeconomic class neighbourhoods. All Year 6 students were included.

The questionnaire was administered in a classroom setting. The feasibility of administrating the instrument under field conditions was also assessed. The same questionnaire was re-administered 1 week later on 35 of the 174 schoolchildren, representing 20.1% of the sample. Apart from content and face validity, psychometric properties of the draft Malay questionnaire were tested by means of factor analysis, internal and test-retest reliability analysis.

Data Analysis

Initially, the 33 items of the drafted Malay questionnaire were reverse scored where indicated. This enabled a student with good oral health knowledge, attitudes, and behaviour to score highly on the scale. Next, the 33 items were factor analysed using principal component analysis (PCA) to extract potential factors (17). The number of factors was limited to 3 factors as there were 3 intended factors or dimensions in the questionnaire. Varimax rotation method with Kaiser Normalization was used for factor loading. The Kaiser-Meyer-Olkin (KMO) test was used to measure the sampling adequacy and Barlett's test of Sphericity to test for sample adequacy and items correlation (18).

Following factor analysis, each factor was analysed for internal and test-retest reliability. Internal reliability was assessed using Cronbach's alpha coefficient (19) and corrected item-total correlation. Test-retest reliability was assessed using intraclass correlation coefficient (ICC) using two-way random effects model and Kappa statistics (17).

Ethical approval was granted by Medical Ethics Committee, Faculty of Dentistry, University of Malaya. Permission to conduct the study was granted by the Planning and Research Division, Ministry of Education, Malaysia, the respective schools, and parents of schoolchildren.

RESULTS

The face and content validity of the questionnaire was verified by experts in dental public health. Its Malay version was also verified to have attained the conceptual and item equivalence with the English version. The face validity of the Malay version was further verified by a

Table 1. Factor analysis of the draft questionnaire showing item loadings into 3 factors (N=174)

Dimension	Factor 1	Factor 2	Factor 3
Oral health knowledge	K1 – K7 (0.414 – 0.579) K10 – K11 (0.147 – 0.486)	K8 – K9 (0.315 – 0.642)	
Oral health attitudes	A1 – A5 (0.385 – 0.588)	A6 – A15 (0.109 – 0.661)	
Oral health behaviour			P1 – P7 (0.116 – 0.669)

Table 3. The Cronbach's alpha, Intraclass Correlation coefficient and Kappa coefficient of the 15 items of OHA dimension

No.	Item / Question	Corrected Item-Total Correlation	Cronbach's Alpha if item deleted
	Brushing teeth is important to me because...		
A1	it prevents my teeth from decay	0.38	0.71
A2	it freshens my breath	0.34	0.72
A3	it prevents my teeth from becoming yellow	0.24	0.72
A4	it is part of the whole body cleanliness	0.37	0.71
A5	it makes my gums healthy	0.44	0.71
A6	it makes my parents happy	0.39	0.71
A7	it helps improve my appearance	0.41	0.70
A8	it makes my friends to like me	0.46	0.70
A9	it makes my dentist to like me	0.37	0.71
	Sweet food and drinks...		
A10	if taken too often can damage my teeth	0.45	0.70
A11	should not be sold at the school canteen	0.21	0.73
A12	should be avoided if possible	0.42	0.70
A13	is my choice almost all the time	0.23	0.73
A14	will not harm my teeth	0.31	0.72
A15	are common during growing up	0.29	0.73
	Cronbach's alpha = 0.73		
	Intraclass Correlation coefficient = 0.70		
	Kappa coefficient = 0.77		

Table 2. The Cronbach's alpha coefficient, Intraclass Correlation coefficient and Kappa coefficient of the 11 items of OHK dimension

No.	Item / Question	Corrected Item-Total Correlation	Cronbach's Alpha if item deleted
K1	Eating too much sugary food can cause tooth decay	0.34	0.57
K2	A person can reduce the risk of tooth decay by reducing sugary food every day	0.32	0.58
K3	Brushing my teeth with a fluoride toothpaste prevents tooth decay	0.24	0.59
K4	For adequate fluoride supply, I must brush my teeth at least twice a day	0.31	0.58
K5	Dental plaque can cause gum disease	0.40	0.56
K6	Gum disease can cause teeth to become loose	0.27	0.58
K7	Brushing my teeth properly improves the health of my gums	0.35	0.57
K8	Using dental floss to clean the areas between my teeth improves the health of my gums	0.20	0.60
K9	Healthy teeth enhance my appearance	0.27	0.59
K10	A person should see a dentist for a dental check-up at least once a year	0.17	0.61
K11	Smoking is bad for oral health.	0.22	0.60
	Cronbach's alpha = 0.61		
	Intraclass Correlation coefficient = 0.72		
	Kappa coefficient = 0.70		

Table 4. The Cronbach's alpha coefficient, Intraclass Correlation coefficient and Kappa coefficient of the seven items of OHB dimension

No.	Item / Question	Corrected Item-Total Correlation	Cronbach's Alpha if item deleted
P1	How often do you brush your teeth?	0.45	0.58
P2	How often do you use toothpaste when brushing your teeth?	0.42	0.58
P3	How often do you rinse your mouth after meal?	0.22	0.64
P4	How often do you use dental floss to clean the areas between your teeth?	0.42	0.56
P5	How often do you drink coca-cola or carbonated drinks with sugars?	0.53	0.52
P6	How often do you eat sweets/chocolates/ice cream?	0.36	0.59
P7	Do you smoke?	0.07	0.64
	Cronbach's alpha = 0.64		
	Intraclass Correlation coefficient = 0.78		
	Kappa coefficient = 0.73		

group of schoolchildren. The questionnaire took 7-10 minutes to answer. The feasibility of the questionnaire administration under field condition was also verified.

Factor analysis of the 33 items revealed 3 factors; Factor 1 = Oral health knowledge, Factor 2 = Oral health attitudes, and Factor 3 = Oral health behaviour (Table 1). Most items which were originally developed for Factor 1 and 2 had loaded into both factors, respectively. Two items which were developed for Factor 1 (K8 and K9) had loaded into Factor 2 while 5 items which were developed for Factor 2 (A1-A5) had loaded into Factor 1. For Factor 3, all the 7 items had loaded into that factor. The 3 factors explained 28.3% of the total variance in the data. Item loading values ranged from 0.147-0.588 for Factor 1, 0.109-0.661 for Factor 2, and 0.116-0.669 for Factor 3. The KMO value was 0.66. The Barlett's test of Sphericity was significant (p<0.001).

For internal and test-retest reliability analyses, attempts were made to analyse each factor with its original items, i.e. Factor 1 with 11 items, Factor 2 with 15 items, and Factor 3 with 7 items. This was despite 7 out of the 33 items had loaded unexpectedly into different factors. Table 2 shows the Cronbach's alpha, ICC and Kappa coefficient of the 11 items of the OHK dimension. The corrected item-total correlation for all items was positive with values ranging from 0.17 to 0.40. Five items had values above 0.3 and 4 items between 0.2-0.3. The Cronbach's alpha coefficient was 0.61 and the value did not increase if any of the items was deleted. The ICC was 0.72 and the Kappa coefficient was 0.70.

Table 3 shows the Cronbach's alpha, ICC and Kappa coefficient of the 15 items of the OHA dimension. The corrected item-total correlation for all 15 items was positive with values ranging from 0.21 to 0.46. Eleven items had values above 0.3 and the rest between 0.2-0.3. The Cronbach's alpha coefficient was 0.73 and the value did not increase if any of the items was deleted. The ICC was 0.70 and the Kappa coefficient was 0.77.

Table 4 shows the Cronbach's alpha, ICC and Kappa coefficient of the 7 items of OHB dimension. The corrected item-total correlation for the 7 items was positive with values ranging from 0.07 to 0.53. Five items had values above 0.3, 1 item between 0.2 – 0.3, and 1 item below 0.1. The Cronbach's alpha coefficient was 0.64 and the value did not increase if any of the items was deleted. The ICC was 0.78 and the Kappa coefficient was 0.73.

DISCUSSION

This study aimed to develop an index called the HPQI to measure the DMP effect on schoolchildren's oral health knowledge, attitudes, and behaviour. It would be used alongside a validated sociodental measure in a larger study on DMP schools (20). The HPQI was developed based on a standard protocol (12) with psychometric analysis (21). Overall, this study has shown that the HPQI was valid and reliable for use among 11-12 year old schoolchildren in Malaysia. Its psychometric properties in terms of face and content validity, and internal and test-retest reliability had been successfully tested and empirically verified.

Overall, the HPQI contains 33 items. They were developed based on the DMP module and included a spectrum of important oral health topics on dental caries, gum disease, fluoride, oral hygiene, self-esteem, dental visit, and smoking habit. These topics are highly relevant to schoolchildren and are included in health talks by DM to their peers at school.

The content and face validity of the English version and the linguistic validation to produce its Malay version were carried out in a systematic way by experts in English and Malay languages and dental public health. Any minor disagreements were resolved through discussions. It was confirmed that the Malay version attained equivalent subject content and meaning to its English version and upon back translation had closely similar wordings to the English version taking into account feedbacks received during the pre-test (16).

In the factor analysis, 2 OHK items (K8-K9) and 5 OHA items (A1-A5) were loaded into Factor 2 and 1, respectively. It was noted that if items A1-A5 were transferred into OHK dimension, this would result in too many toothbrushing-related items. Likewise, inclusion of items K8-K9 into OHA dimension would not fit well with the toothbrushing and sweet food and drinks domains. Furthermore, the subsequent internal reliability analyses were moderate. A detailed discussion with dental public health experts led to the suggestion that items K8-K9 and A1-A5 could remain in OHK and OHA subscales, respectively, if the items were reliable as a group to measure the construct they were supposed to measure. Thus, it was decided that the reliability analyses of OHK, OHA and OHB dimensions were carried out with their items remained in the respective dimensions. In the factor analysis, the KMO value was 0.66 indicating the sample size was adequate for factor analysis (18). The Barlett's test of Sphericity was significant indicating factor analysis was appropriate for all items (17).

The internal and test-retest reliability analyses of the 3 factors showed satisfactory outcomes. The Cronbach's alpha coefficients for OHK, OHA, and OHB dimensions were 0.61, 0.73 and 0.64, respectively, indicating the 3 dimensions are reliable to constitute an index to measure schoolchildren's oral health knowledge, attitudes, and behaviour in the Malaysian setting (22). The Cronbach's alpha coefficients did not increase if any of the items was deleted indicating no item should be removed as the items were highly correlated and relevant in each dimension. The corrected item-total correlation values for all items in OHA and most items in OHK and OHB dimensions were 0.2 or above, except for item K10 and P7 where the values were 0.17 and 0.07, respectively. This indicates all items in OHA and most items in OHK and OHB dimensions correlated well with the total score in each dimension, respectively (17). Although items K10 (dental visit) and P7 (frequency of smoking) had values below 0.2, both items were deemed essential items to measure frequencies of dental visits and smoking habit among the children. Dental visit and smoking habit are part of the messages in the DMP oral health module and it was decided both items should be included in the questionnaire. In terms of test-retest reliability, the questionnaire had been proven to be reliable in yielding consistent scores at different times. The ICC for OHK, OHA and OHB dimensions were excellent with values between 0.70-0.78. Likewise, the Kappa coefficients were substantial to excellent with values between 0.70-0.77 (23).

Apart from evaluating the impacts of DMP on schoolchildren's levels of OHK, OHA, and OHB, the index or its separate subscales may also be used as an evaluation tool for any oral health intervention as the items are highly relevant to assess oral health education and promotion outcome.

This study had several limitations. Only literate students may answer the questionnaire satisfactorily. Children with learning difficulties may need help in understanding the questionnaire. Future studies should address this limitation. Also, a few students needed help in the answering technique despite the written instruction. It is recommended that a verbal instruction be given to students with the researcher present when administering the questionnaire.

CONCLUSION

The Health Promotion Questionnaire Index (HPQI) to measure the DMP impact on schoolchildren's oral health knowledge, attitudes, and behaviours has been successfully developed and empirically verified to be valid and reliable for use among 11-12 year old Malay schoolchildren in Malaysia.

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