ORIGINAL ARTICLE

Adaption, translation and validation of the Diabetes Mellitus in the Offspring Questionnaire (DMOQ): The Malay version

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ABSTRACT

Background: The Diabetes Mellitus in the Offspring Questionnaire (DMOQ) assesses the perceptions of Type 2 diabetes mellitus (T2DM) patients on the risk of their offspring developing T2DM and the possibility of intervention to reduce this risk. It has 34 items framed within seven domains. This study aimed to adapt, translate and validate the DMOQ from English into the Malay language.

Methods: This was a cross-sectional validation study among 159 T2DM patients attending a public primary care clinic in Selangor. The DMOQ English version underwent adaptation, translation, face validation and field testing to produce the Malay version. Psychometric analysis was performed using Exploratory Factor Analysis, internal consistency and test-retest reliability.

Results: The DMOQ domains were conceptually equivalent between English and Malay language. A total of 13 items and two domains were removed during the validation process (three items during the content validation, three items due to poor factor loadings, five items as they loaded onto two domains which were not interpretable, one item as it did not fit conceptually into the factor it loaded onto and one open-ended question as it did not fit into the retained domains). Therefore, the final DMOQ Malay version consisted of 21-items within five domains. The Cronbach alpha was 0.714 and the intraclass-correlation coefficient was 0.868.

Conclusion: The DMOQ Malay version is a valid and reliable tool which is consistent over time. It can be used to examine the perception of T2DM patients towards the risk of their offspring developing diabetes and possibility of intervention in Malay-speaking patients.

KEY WORDS:
Diabetes mellitus, offspring, perception, validation, adaptation, translation, questionnaire

INTRODUCTION

Diabetes mellitus is one of the world's commonest non-communicable diseases (NCDs) and is also undoubtedly one of the most challenging health disorders of the 21st century.[1] In Malaysia, the overall prevalence of diabetes mellitus among adults of ≥18 years was reported at 15.2% (95% CI: 14.3 - 16.1) according to the latest National Health Morbidity Survey in 2011.[2] Out of those who have diabetes mellitus, 52.6% were newly diagnosed.[2] Therefore preventing diabetes has become an important public health issue especially in high-risk groups. One of the high-risk groups of interest is offspring of Type 2 diabetes mellitus (T2DM) patients.

Offspring of patients with T2DM are known to have an increased risk of developing T2DM.[3] Evidence has shown that having one parent with T2DM increases an offspring's chance of developing diabetes between two and four-fold, especially if the affected parent is the mother.[4] Studies have also shown that family members living together tend to adopt similar lifestyle habits,[5] which may predispose them to develop T2DM. A starting point to making changes in the family is to encourage patients with diabetes to become the health promoter within the family to talk about risk of diabetes with their offspring.[6]

The concept of risk perception also known as perceived probability, likelihood, susceptibility or vulnerability is a central construct of many health behaviour models addressing health-protective behaviours.[7] This concept hypothesizes that the higher the perceived threat or likelihood of developing a certain disease, the more likely an individual will modify his or her behaviour. In addition, individuals will alter their behaviour and take action to prevent diabetes in their offspring only if they perceive their offspring to be at risk of the condition.[8]

Therefore, ascertaining the risk perception of T2DM patients is important prior to introducing preventive lifestyle interventions in the family. This measure is crucial to identify individuals who are willing to become agents of change to promote preventive lifestyle strategies within the family to help prevent diabetes mellitus in their offspring. Whitford et

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al. had previously studied risk perception among patients with T2DM and their willingness to accept training to deliver preventive lifestyle intervention in their offspring.[9] They developed a questionnaire in the English language which was later named the Diabetes Mellitus in the Offspring Questionnaire (DMOQ).

However, to date, risk perception of T2DM patients has never been studied in the Malaysian context. To our knowledge, there is no available or validated tool in the Malay language to measure risk perception of patients with T2DM. This paucity of evidence led to this study which aims to adapt and translate the original DMOQ from the English language into the Malay language and to subsequently examine the psychometric properties of the translated Malay version. This tool could then be used within our local setting to gain a better understanding of risk perceptions among T2DM patients and potential interventions to reduce the risk of T2DM in their offspring.

MATERIALS AND METHODS

This was a cross-sectional questionnaire validation study. It was conducted in three phases: Phase 1: Adaptation and translation of the DMOQ from the original English language into the Malay language, Phase 2: Face validation of the DMOQ Malay version and Phase 3: Field testing and psychometric analysis of the DMOQ Malay version. The process of Phase 1 until Phase 3 is outlined in the flow chart presented in Figure 1.

The DMOQ was developed based on the parameters of the Health Belief Model (HBM) which formed the underlying conceptual framework.[6] It contained 34 items framed within seven domains assessing the perceptions of T2DM patients concerning risk of their first degree relatives developing T2DM and the possibility of intervention in the family.[9] The seven domains included 1) knowledge of risk factors to develop and prevent T2DM, 2) perceived severity, 3) perceived susceptibility, 4) perceived barriers, 5) perceived benefits, 6) cues to action and 7) Health Value scale.

In Phase 1, The DMOQ English version underwent a process of adaptation which included content validation. An expert panel consisted of four family physicians reviewed the original 34-item DMOQ English version for conceptual and item equivalence. The panel rated the relevance of each item to the conceptual framework. Changes were made to the original questionnaire to suit the study's objectives, local language and culture. The original 34-item DMOQ English version included questions to assess the perception of T2DM patients on their offspring's and siblings' risk of developing T2DM. However, in the Malaysian context, T2DM patients were thought to be more likely to introduce health-related actions towards risk reduction to their offspring compared to their siblings. Therefore, during the process of content validation, the expert panel agreed on removing three items that examined risk perception on siblings. It was then forward and back-translated according to the guidelines for cross-cultural adaptation and translation studies.[10-12] At the end of Phase 1, the 31-item DMOQ Malay-Harmonized (M-H) version was produced.

In Phase 2 of the study, the DMOQ M-H version underwent face validation on the target population. It was piloted on 30 T2DM patients who were receiving care at the NCD clinic in a public primary care clinic. In this study, only one clinic was chosen for the recruitment of patients because this clinic is a typical public primary care clinic located in a semi-urban area serving up to 400 T2DM patients per week with approximately 5000 active T2DM patients in the register. Therefore, it provided a good pool of patients as a sampling frame for this study.

The inclusion criteria included T2DM patients aged ≥18 years old who have at least one offspring that does not have T2DM and were able to speak and understand written Malay language. Foreigners, pregnant women and patients with Type 1 Diabetes Mellitus, mental disorders, visual impairment and those who did not give informed consent were excluded from the study. The face validation was conducted to assess their understanding of the purpose, content, wording, instructions and general structure of the DMOQ M-H version. Correction and fine tuning of the DMOQ M-H version by the research team was done based on the patients' feedback. This process revealed that 25.1% of the participants found that the Likert scales throughout the questionnaire were confusing as they varied in even and odd numbered scales, ranging between 4 to 7-point Likert scale. Based on the participants' feedback, all items were changed to a standardized 5-point Likert scale throughout the questionnaire. This revised DMOQ M-H version underwent a second face validation by another 30 T2DM patients from the NCD clinic. The feedback obtained showed that the questionnaire was satisfactory and no further amendment was required. The face validated DMOQ M-H version was ready for field testing. Patients who took part in Phase 2 (face validation) and Phase 3 (field testing) were mutually exclusive, as those who participated for the Phase 2 were not re-selected for the Phase 3 of this study.

In Phase 3, the DMOQ M-H was field tested on T2DM patients who were receiving care at the NCD clinic at the same public primary care clinic from September to October 2015. The same inclusion and exclusion criteria were applied for selection of the participants.

The sample size for field testing of the DMOQ M-H in Phase 3 was calculated using the subject to item ratio. The rule of thumb recommends the subject to item ratio of between 3:1 to 20:1.[13] For this study, a subject to item ratio of 5:1 was used. As there were 31 items retained within DMOQ M-H, the minimum required sample estimated was 155 participants. Taking into consideration of a 20% non-responder and non-eligibility rate, this study aimed to approach 194 participants.

Convenience sampling was used to recruit T2DM patients from the clinic. This method was chosen due to time constraint for data collection. There was also difficulty to conduct probability sampling as the clinic only had the paper-based registry for their T2DM patients. Patients who attended the NCD clinic on the day of the data collection were approached and invited to participate in the study. Those who agreed were screened for eligibility according to

the inclusion and exclusion criteria. Medical records were also checked for secondary data for confirmation of details. Those who were eligible were recruited into the study and written informed consent was obtained.

Demographic data were collected via face-to-face interview. The participant was then given the self-administered DMOQ M-H questionnaire. Clear instructions were given on how to fill up the questionnaires. They were reminded to answer the questionnaires themselves rather than getting their family members to complete it. Upon completion, participants returned the questionnaire to the researcher who then checked for completeness. The participants were given a date to return to the clinic in two weeks' time to complete the same questionnaire for test-retest reliability analysis.

We had obtained written permission from Professor David L.Whitford of the Royal College of Surgeons, Ireland to adapt, translate and validate the DMOQ. The medical ethics and research committees of Universiti Teknologi MARA [600-RMI (5/1/6)] and the Ministry of Health Malaysia [NMRR-14-1861-22954(IIR)] approved the study protocol.

Statistical analysis

Data entry and statistical analysis were performed using IBM SPSS Statistics Version 21.[14] The Likert Scale responses for the negatively phrased questions were reversed during the data entry. In the descriptive analysis, categorical variables were presented as frequency and percentages. Mean and standard deviation (SD) were reported for normally distributed continuous data while median and interquartile range (IQR) were reported for non-normally distributed continuous data.

Assessment of sampling adequacy and appropriateness of data for further factor exploration was conducted by estimating the Keiser-Meyer-Olkin (KMO) and Bartlett's test of sphericity values respectively. The KMO index was reported in a range of 0 to 1, with values of >0.50 considered suitable for proceeding to factor analysis.[15] A significant Bartlett's Test of Sphericity with a p-value <0.05 was considered suitable for factor analysis.[15] The construct validity of DMOQ M-H was assessed using exploratory factor analysis (EFA) with varimax rotation.

Reliability of the DMOQ M-H was assessed using Cronbach alpha coefficient as a measure of internal consistency. A Cronbach alpha coefficient value of >0.7 was considered reliable.[15] Intraclass correlation coefficients (ICC) were used to assess test-retest reliability of the questionnaire. The higher the values nearing 1.00, the more stable the items over time.[15]

RESULTS

A total of 194 T2DM patients were approached, 16 refused to participate and 19 did not fulfil the inclusion or exclusion criteria. Therefore, 159 patients were recruited and completed the DMOQ M-H. Majority of the patients were Malay (86.2%) with a mean age of 54.87 years (SD 8.22). The mean number of offspring without T2DM was 4 (SD 1.47). The sociodemographic and clinical characteristics of the participants are presented in Table I.

Of the 31 items in the DMOQ M-H, only 29 underwent EFA as the other two were open-ended items in the form of a subjective response. The values of the inter-item correlation between the 29 items were above 0.3, and this was considered acceptable. The KMO value was 0.659 with a significant p-value of <0.001 for the Bartlett's test of sphericity. Both these values indicate that this data set was suitable to proceed for further factor analysis.

On the first run principal component analysis (PCA) of the EFA, the total variance of the DMOQ M-H version was 66.29%. During application of the Kaiser's criterion, ten factors were extracted having eigenvalues exceeding 1.0, thus suggesting ten factors to be retained. On the other hand, the elbow of the Scree plot occurred at factor 5 as the line starts to straighten, suggesting that four factors should be retained. Both the Kaiser criterion and the Scree test suggested retaining a different number of factor solutions. Among four to ten factor solutions examined, a seven-factor solution with Varimax rotation was deemed to be the most conceptually appropriate to the DMOQ M-H version. Therefore, the data were reanalysed by fixing the number of factors at seven factors.

During the EFA process, three items (CUE1, HVS2, HVS3) were removed due to poor factor loading of <0.4 following factor rotation. A further five items (K1, K6, K7, SEV2, and SEV5) which loaded onto two factors ('cues to action' and 'Health Value scale') were also removed as the factors were unidentifiable according to the underlying conceptual framework. Another one item (HVS1) was removed as it did not fit conceptually with the factor it loaded onto. A total of nine items were removed from the DMOQ M-H, therefore, 20 items within five-factors were retained for the final run of the PCA. Table II shows the factor loadings of the final PCA and their factorial weights which accounted for 56.34% of the total variance. Percentages of variance explained by the individual domains 1, 2, 3, 4 and 5 were 18.08%, 14.31%, 9,69%, 8.26% and 5.997% respectively.

Of the two open-ended items which were not evaluated using EFA, one item was removed as its original domain was removed during EFA. Another open-ended item which reflected the patients' knowledge of risk factors and risk reduction of diabetes mellitus was reinserted into the factor 'knowledge of risk factors'. Therefore, the final DMOQ Malay version consisted of 21 items framed within 5 domains.

This final version of the DMOQ Malay underwent reliability analysis to determine the internal consistency with the Cronbach alpha values for each domain ranging from 0.592 to 0.810 as shown in Table III. The intra-class correlation coefficient value was 0.868.

DISCUSSION

This study was the first study carried out in the Malaysian primary care setting to adapt, translate and validate a tool to assess perception among patients with T2DM regarding the risk of their offspring developing T2DM and possibility of preventive measures. The DMOQ Malay version has undergone a rigorous process in which the content, face and

Table I: Socio-demographic and clinical characteristics of patients

Characteristics of participants		Study sample n = 159	(%)	Mean (SD)
Age				54.87 (8.22)
Gender	Male	77	48.4	
	Female	82	51.6	
Ethnicity	Malay	137	86.2	
	Indian	12	7.5	
	Chinese	7	4.4	
	Others	3	1.9	
	Bumiputra Sabah and Sarawak	0	0	
Duration of T2DM				7.05 (6.37)
Treatment of T2DM	Treatment with diet and medications	109	68.6	
	Treatment with diet and insulin	38	23.9	
	Treatment with diet, medications and insulin	7	4.4	
	Treatment with diet alone	5	3.1	
Family history	Parents with T2DM	56	35.2	
	Siblings with T2DM	35	22.0	
	Both siblings and parents	28	17.6	
	No family history of T2DM	40	25.2	
Number of offspring without T2DM				4 (1.47)
Personal status	Married	139	87.4	
	Widowed	19	12.0	
	Divorced/Separated	1	0.6	
	Single	0	0	
Highest education level	No formal education	4	2.5	
	Primary school education	21	13.2	
	Secondary school education	87	54.7	
	Tertiary education	47	29.6	

Table II: Factor loadings on the final five factor solution PCA

Coding	Items	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
	Perceived barrier	Loadings				
BAR1	I do not have a healthy lifestyle myself	0.555				
BAR2	I do not have much contact with my relatives	0.671				
BAR3	My relatives are not open to advice from me	0.779				
BAR4	They do not see diabetes as a serious illness	0.782				
BAR5	They do not believe they are at risk of getting diabetes	0.787				
HVS4	There are many things I care about more than my health	0.530				
	Perceived benefits		Loadings			
CUE2	If I were offered training in how to speak to my children about their risk of getting diabetes and what they can do to reduce this risk, I would be willing to speak to them about it.		0.513			
BEN1	Make my relatives more aware of the importance of diet and exercise		0.744			
BEN2	Encourage them to make changes to their lifestyle		0.837			
BEN3	Help prevent them developing diabetes		0.790			
	Perceived severity			Loadings		
SEV1	Severity of cancer			0.897		
SEV3	Severity of diabetes			0.697		
SEV4	Severity of AIDS			0.903		
	Perceived susceptibility				Loadings	
SUSCEP1	How likely do you think it is that any of your children will get diabetes sometime in their life?				0.647	
SUSCEP2	How likely do you think it is that someone will get diabetes if he or she does not have a family history of diabetes?				0.626	
SUSCEP3	Do you worry that your children might get diabetes sometime in their life?				0.591	
	Knowledge of risk factors					Loadings
K2	Being overweight					0.602
K3	High salt intake					0.630
K4	Taking little or no exercise					0.712
K5	Being over 40 years of age					0.618

Table III: The Cronbach alpha values of each of the domains in the DMOQ Malay version

Domain	Cronbach alpha
Perceived barriers	0.776
Perceived benefits	0.666
Perceived severity	0.810
Perceived susceptibility	0.612
Knowledge of risk factors	0.592

construct validation and reliability analysis were conducted according to well-established guidelines.[10-12] Investigation of the conceptual equivalence of the items in the DMOQ by the expert committee during content validation found that the domains employed in the original DMOQ were equally relevant and important in the target population. This indicates that the domains employed in the original questionnaire were likely to be equally valid in the Malaysian population. However, the original 34-item DMOQ English version included three items assessing the perception of T2DM patients on their siblings' risk of developing T2DM. In the Malaysian context, T2DM patients were thought to be more likely to introduce health-related actions towards risk reduction to their offspring compared to their siblings. Siblings of T2DM patients may have similar age profile to the patients themselves, making preventive actions towards risk reduction of T2DM less effective compared to preventive measures among their offspring.[16] Thus, the three items pertaining to risk perception of siblings were removed by the expert committee from the DMOQ Malay version at this stage. This move was supported by the literature which mainly examines risk perceptions of patients towards their offspring developing T2DM[4,6,17] and also offspring's views on risk perception of developing T2DM.[4,17-19]

The final validated DMOQ Malay version consisted of 21 items framed within the following five domains: 1) knowledge of risk factors to develop and prevent T2DM, 2) perceived severity, 3) perceived susceptibility, 4) perceived barriers, 5) perceived benefits. However, the original DMOQ in the English language was made up of seven factors with 34 items.[6] Table IV shows a comparison of the domains and items between the original DMOQ English version and the Malay version.

Although the DMOQ Malay version consisted of only 21 items framed within five domains, this study has proven that this tool is valid, reliable (Cronbach alpha of 0.714) and stable over time (ICC of 0.868) to measure the perception of T2DM patients regarding risk of their offspring in developing T2DM. The omission of 13 items and two domains should not affect the construct validity of the final five-factor solution of the DMOQ Malay version because the remaining 21 items which are retained represent the main four domains of the original HBM. These domains include perceived barriers, perceived benefits, perceived susceptibility and perceived severity. Therefore, the remaining 21 items framed within five domains reflects a good understanding of the subject being investigated.

Our study found that 'perceived barriers' was the most significant domain as it has the highest total variance compared to the other HBM domains. This was consistent with findings from a study by Becker et al.[20] which reviewed the HBM domains from preventive health behaviour studies between 1974-1984. They found that 'perceived barriers' was the most powerful HBM construct across the various study designs and behaviours examined. Their study also found that 'perceived susceptibility' and 'perceived benefits' were both equally important and that 'perceived severity' produced the lowest overall significance ratio. However, our study found 'perceived susceptibility' produced less significant total variance compared to 'perceived severity' which was not consistent with findings from Becker et al.[20]

Our study shows the Cronbach alpha coefficient values for the five domains ranged between 0.592 to 0.810. Generally, a Cronbach alpha coefficient value of >0.7 was considered reliable.[15] In our study, the Cronbach alpha values for perceived benefits and perceived susceptibility were 0.666 and 0.612, respectively. However, when dealing with psychological constructs such as these, values <0.7 can realistically be expected because of the diversity of the constructs being measured.[21] The values of Cronbach alpha also depend on the number of items in the domains.[21] A larger number of items within a domain usually yields a higher Cronbach alpha value.[22] In our study, the domain of knowledge of risk factors only contained four items following omission of three items which explains the Cronbach alpha value of 0.592. These findings are comparable to the translated and validated DMOQ Arabic language which consisted of 34 items framed within seven domains.[9] In their study, the Cronbach alpha coefficient values for the seven domains ranged between 0.45 to 0.88.[9]

Study limitations

One of the study limitations was that the DMOQ can only be administered to T2DM patients who were able to read and understand the Malay language. As a result, a majority of patients who were included in this study were of the Malay ethnic group. Therefore, the findings of this study would only be generalisable to the Malays who could read and understand the Malay language. There is a need to translate and validate this questionnaire into other languages such as Mandarin and Tamil to give better utilisation in a multi-ethnic Malaysian population.

This study was, however, conducted in only one clinic. Therefore, the findings may not be generalisable to other clinics which do not share similar patient characteristics. Another limitation of the study is the convenience sampling method which may be vulnerable to sampling bias. However, measures were taken by the researchers to approach all T2DM patients who attended the NCD clinic on data collection days. During the adaptation, translation and validation process to produce the final DMOQ Malay version,

Table IV: Comparison of concepts and items in the original DMOQ English and Malay versions

No	Concept	English version Items		Malay version Items	
1	Knowledge of diabetes risk factors	7 items	1. Having a parent with type 2 diabetes 2. Being overweight 3. High salt intake 4. Taking little or no exercise 5. Being over 40 years of age 6. Having a brother or sister with type 2 diabetes 7. I don't know	4 items	1. Being overweight 2. High salt intake 3. Taking little or no exercise 4. Being over 40 years of age
	Knowledge of risk reduction of diabetes mellitus	1 item	How do you think a person can reduce his/her risk of getting diabetes?	1 item	How do you think a person can reduce his/her risk of getting diabetes?
2	Perceived susceptibility	5 items	1. How likely do you think it is that any of your children will get diabetes sometime in their life? 2. How likely do you think it is that any of your brothers and sisters will get diabetes sometime in their life? 3. How likely do you think it is that someone will get diabetes if he or she does not have a family history of diabetes? 4. Do you worry that your children might get diabetes sometime in their life? 5. Do you worry that your brothers and sisters might get diabetes sometime in their life?	3 items	1. How likely do you think it is that any of your children will get diabetes sometime in their life? 2. How likely do you think it is that someone will get diabetes if he or she does not have a family history of diabetes? 3. Do you worry that your children might get diabetes sometime in their life?
3	Cues to action	3 items	1. Have you ever talked to any of your children about the possibility of them getting diabetes? 2. Have you ever talked to any of your brothers and sisters about the possibility of them getting diabetes? 3. If I were offered training in how to speak to my children and brothers and sisters about the risk of getting diabetes and what they can do to reduce this risk, I would be willing to speak to them about this.	0 item	
	Motivation to cues to action	1 item	What would help you to speak to your relatives about their risk of getting diabetes and what they can do to reduce this risk?	0 item	

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No	Concept		English version Items		Malay version Items
4	Perceived benefits	3 items	1. Make my relatives more aware of the importance of diet and exercise. 2. Encourage them to make some changes to their lifestyle. 3. Help prevent them developing diabetes.	4 items	1. Make my relatives more aware of the importance of diet and exercise. 2. Encourage them to make some changes to their lifestyle. 3. Help prevent them developing diabetes. 4. If I were offered training in how to speak to my children and brothers and sisters about the risk of getting diabetes and what they can do to reduce this risk, I would be willing to speak to them about this.
5	Perceived barriers	5 items	1. I do not have a healthy lifestyle myself. 2. I do not have much contact with my relatives. 3. My relatives are not open to advice from me. 4. They do not see diabetes as a serious illness. 5. They do not believe they are at risk of getting diabetes.	6 items	1. I do not have a healthy lifestyle myself. 2. I do not have much contact with my relatives. 3. My relatives are not open to advice from me. 4. They do not see diabetes as a serious illness. 5. They do not believe they are at risk of getting diabetes 6. There are many things I care about more than my health. 6. There are many things I care about more than my health.
6	Perceived severity	5 items	Please indicate how serious you think the following problems are: 1. Cancer 2. Flu 3. Diabetes 4. AIDS 5. Arthritis	3 items	Please indicate how serious you think the following problems are: 1. Cancer 2. Diabetes 3. AIDS
7	Health Value Scale	4 items	1. There is nothing more important than good health. 2. Good health is only of minor importance in a happy life. 3. If you don't have your health, you don't have anything. 4. There are any things I care about than my health.	0 items	
	Total	34 items	Total	21 items	

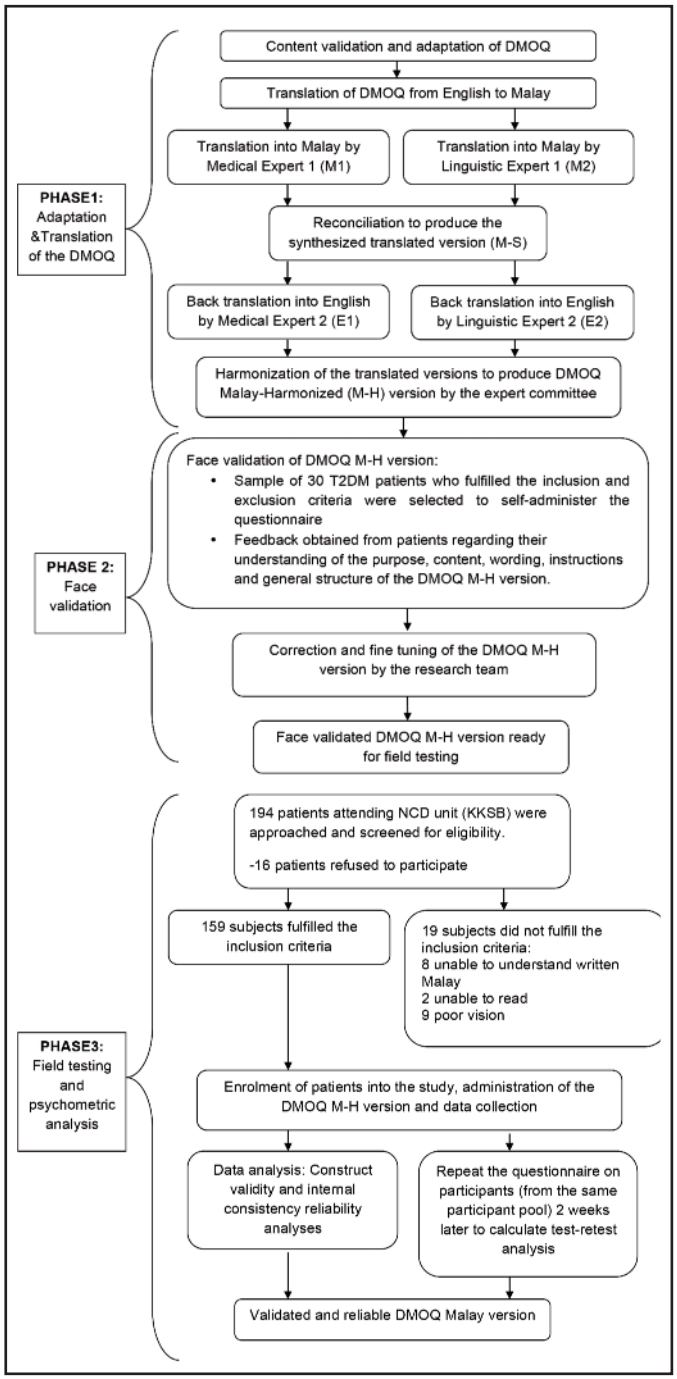

Fig. 1: Flow chart of the conduct of the study.

the number of items and domains has been considerably reduced due to the omission of items. Therefore, the findings from the DMOQ Malay version may not be comparable to the findings in studies which use the original DMOQ English version.

Implications for clinical practice and future research

The validated DMOQ Malay version can now be utilised to examine the perception of T2DM Malay speaking patients towards the risk of their offspring in developing diabetes. This information would provide a better understanding of matters related to risk perceptions and potential intervention to reduce this risk in the Malaysian population. Health care professionals and policy makers may then develop effective training strategies for the T2DM patients to become the 'change agent' to prevent their offspring from developing T2DM. Future research may include intervention studies to evaluate the effectiveness of T2DM patients as agents of change to promote preventive lifestyle strategies in preventing their offspring from developing T2DM.

However, to strengthen the rigour of the DMOQ Malay version for future research, further validation studies should include multiple clinics using purposive quota sampling involving other ethnic groups in Malaysia. Statistical analyses using the structured equation modelling and confirmatory factor analysis for the DMOQ Malay version is recommended.

The number of items and domains has been considerably reduced due to the omission of items during the adaptation, translation and validation process to produce the final DMOQ Malay version. Therefore, to increase the reliability of each domain, adding more items which are locally relevant in future validation studies is recommended.

CONCLUSION

The DMOQ Malay version is a valid and reliable tool which could potentially be useful to examine the perception of T2DM patients towards the risk of their offspring in developing diabetes and possibility of intervention in Malay-speaking patients. This information would provide a better understanding to develop effective training strategies for the T2DM patients to become the 'agent of change'. Future research includes the use of DMOQ in intervention studies evaluating the effectiveness of T2DM patients as change agents in preventing their offspring from developing T2DM.

CONFLICTING OF INTERESTS

The authors declared no potential conflicts of interest with respect to the authorship and/or publication of this article.

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