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EVALUATING THE PERCEPTIONS OF T2DM PATIENTS TOWARDS THE RISK AND PREVENTION OF T2DM IN THEIR OFFSPRING

ANIS SAFURA RAMLI

SABBATICAL LEAVE REPORT

NOVEMBER 2016

AUTHOR'S DECLARATION

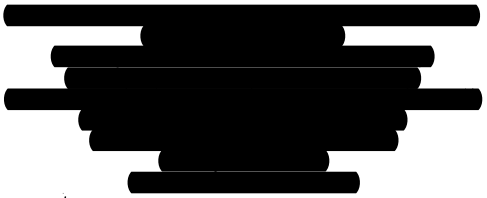
I declare that the work in this report was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work and the work of my research team members, unless otherwise indicated or acknowledged as referenced work. This report has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the academic rules and regulations for academic staff, Universiti Teknologi MARA, regulating the conduct of my study and research.

Name of Staff	: Anis Safura Binti Ramli
Staff No.	: [redacted]
Programme	: Sabbatical Leave
Faculty	: Medicine
Thesis Title	: Evaluating the perceptions of T2DM patients towards the risk and prevention of T2DM in their offspring

Signature of Staff:

Date : 30th Nov 2016



ACKNOWLEDGEMENTS

Firstly, my utmost gratitude is to Allah S.W.T for giving me the strength to complete my sabbatical leave project and the final report. My special thanks to my supervisor, Dr Jamaiyah Haniff who has given her support and guidance throughout this project. I also wish to thank my research team members: Dr Siti Fatimah Badlishah Sham, Dr Nurzakiah Mohd Zaki, Dr Mohamad Rodi Isa, Dr Han Yung Wen and Professor Dr David Whitford for their contributions towards this project. My appreciation also goes to the Ministry of Higher Education for funding this project [grant code: 600-RMI/RAGS 5/3 (78/2014)], and the National Clinical Research Centre, Ministry of Health, Malaysia for providing the research support facilities for this project.

I also would like to thank the Family Medicine Specialists of Klinik Kesihatan Sungai Buloh (KKSB); Dr Maimunah Mahmud and Dr Wan Farzihan Wan Adib as well as the nurses and support staff of the Non-Communicable Diseases Unit of KKSB who provided facilities and assistance during the data collection.

Finally, I would like to express my greatest appreciation to my husband and three children for their support and understanding.

Alhamdulillah

PART 1

ADAPTATION, TRANSLATION AND VALIDATION OF THE DIABETES MELLITUS IN THE OFFSPRING QUESTIONNAIRE (DMOQ): THE MALAY VERSION

ABSTRACT

INTRODUCTION

Offspring of T2DM patients have an increased risk of developing T2DM. One of the approaches to prevent their offspring from developing T2DM is to encourage T2DM patients to become the health promoter within the family. The Diabetes Mellitus in the Offspring Questionnaire (DMOQ) assesses the perceptions of T2DM patients on the risk of their first degree relatives in developing T2DM and the possibility of intervention to reduce this risk. The DMOQ English version consisted of 34-items framed within seven concepts based on the Health Belief Model.

OBJECTIVES

This study aimed to adapt and translate the DMOQ from the English language into the Malay language and to subsequently examine the psychometric properties, specifically determining its validity and reliability.

METHODS

This was a cross sectional questionnaire validation study among T2DM patients receiving care from the Non-Communicable Disease Clinic at Klinik Kesihatan Sungai Buloh. It was conducted in three phases: i) adaptation and translation of the DMOQ from the English language into the Malay language, ii) face validation and iii) field testing of the DMOQ Malay version to examine its psychometric properties. During the process of content validation, three items were removed as these were questions pertaining to siblings. Forward and back translations were carried out by credible translators. Face validation was conducted on 20 participants. Based on the participants' feedback, correction and fine tuning was conducted to produce the DMOQ Malay-Harmonised (M-H) version. A total of 159 T2DM patients were

recruited via convenience sampling for the field testing and data was collected via self-administration of the DMOQ M-H version. Construct validity was determined using Exploratory Factor analysis (EFA). Reliability was determined by the internal consistency reliability and test-retest reliability.

RESULTS

A total of 12 items were removed during the whole process of adaptation, translation and validation of the DMOQ which included a further three items being removed due to poor factor loadings of <0.40 following the EFA. Subsequent to rotation of the matrix with a seven factor solution, five items which loaded onto two factors which were not interpretable according to the underlying conceptual framework were also removed. One open ended question was also removed as it did not fit into any of the retained concepts. Therefore, the final DMOQ Malay version consisted of five concepts and 22 items. The Cronbach alpha was 0.714 which meant an acceptable internal consistency and the test-retest analysis was also consistent over time.

CONCLUSION

The DMOQ Malay version is a valid and reliable research tool which can be used to assess the risks perception among T2DM patients in Malaysia. This information is vital to aid health care professionals and policy makers in developing effective training strategies for the T2DM patients to become the 'agent of change' to prevent their offspring from developing T2DM.

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LIST OF ABBREVIATIONS

T2DM	Type 2 Diabetes Mellitus
DMOQ	Diabetes Mellitus in the Offspring Questionnaire
M-H	Malay-Harmonised
EFA	Exploratory Factor Analysis
NCD	Non-communicable disease
NSP-NCD	National Strategic Plan for Non-Communicable Disease
DMOQ-R	Diabetes Mellitus in the family questionnaire-Relatives
HBM	Health Belief Model
HVS	Health Value Scale
DPS	Diabetes Prevention Study
DPP	Diabetes Prevention Programme
IDPP	Indian Diabetes Prevention Programme
MTF	Metformin
LSM	Lifestyle modifications
LSM+MTF	Lifestyle modifications + Metformin
RPD-DD	The Risk Perception Survey-Developing Diabetes
SCA	Scientific Advisory Committe
CFA	Confirmatory Factor Analysis
ICC	Intraclass correlation coefficient
SVR	Sample to Variable Ratio
KKSB	Klinik Kesihatan Sungai Buloh
SPSS	Statistical Package for the Social Sciences
KMO	Kaiser-Meyer-Olkin
PCA	Principal Component Analysis
PAF	Principal Axis Factoring
NMRR	National Medical Research Register

MREC	Medical Ethics and Research Committe
FMS	Family Medicine Specialist
TESL	Teaching English as a Second Language

LIST OF APPENDICES

CHAPTER 1: INTRODUCTION

1.1 Background of the study

1.1.1 The global prevalence and burden of Type 2 Diabetes Mellitus

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). The prevalence is increasing at such an alarming rate in that the International Diabetes Federation predicts that the number of people living with Diabetes Mellitus globally will rise from 366 million in 2011 to 552 million by the year 2030 (2). This equates to almost ten million new cases of Diabetes Mellitus every year. Diabetic complications are very common with at least 50% or more patients presenting with it during diagnosis (1) and are a major cause of disability, poor quality of life and even death.

In 2009, Diabetes Mellitus was noted to be the seventh leading cause of death in the United States (3). The risk of death amongst people with Diabetes Mellitus is reported to be about twice that of people of a similar age group who did not have Diabetes (4). Type 2 Diabetes Mellitus (T2DM) is by far the most common form of Diabetes Mellitus, accounting for over 90 per cent of cases worldwide (5).

1.1.2 The prevalence and burden of Type 2 Diabetes Mellitus in Malaysia

In Malaysia, the overall prevalence of Diabetes Mellitus among adults of 18 years and above was reported at 15.2% (95% CI: 14.3 - 16.1) according to our latest National Health Morbidity Survey in 2011 (6). This data has also shown an increase of the overall prevalence of Diabetes Mellitus from 14.9% in the previous National Health Morbidity Survey in 2006. Of these patients, 7% were known to have Diabetes Mellitus, however, what is more alarming is that 8% of them were unknown to have Diabetes Mellitus. This is consistent with many population based studies which show a substantial amount of those found to have Diabetes Mellitus were not previously diagnosed, largely because they may have very few symptoms early on in the disease (1).

The epidemic of Diabetes Mellitus and their subsequent microvascular and macrovascular complications pose a real and significant threat to Malaysia. It is unfortunate that despite efforts taken within the Ministry of Health since the 1990's, the prevalence of non-communicable disease continue to rise at an alarming rate as reported in our subsequent National Health and Morbidity surveys.

As an intensive effort to manage this disease at the primary care level, the National Diabetes Prevention and Control Program was strengthened in the year 2000 (7). Significant progress has since been made in the provision of care to Diabetes Mellitus patients. This includes the setting up of dedicated Diabetes Mellitus services, formation of diabetic teams and also resource centres.

1.1.3 Risk factors for developing Type 2 Diabetes Mellitus

T2DM results from a combination of genetic and lifestyle factors (8, 9). Risk factors for developing T2DM are well established and include increasing age, ethnicity, having a family history of Diabetes, being overweight, unhealthy diet and physical inactivity to name a few (10). Even though the genetic predisposition of an individual is considered an essential factor in the development of T2DM, the presence of environmental and behavioural factors plays a part in activation of these genes (11).

First degree relatives (siblings and children) of patients with T2DM are found to have an increased risk of developing T2DM (12). 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 (13). This is equivalent to an absolute risk of 20-40% of developing T2DM in the children of one parent with T2DM. However, researchers are wary that current studies looking at the emergence of Diabetes in offspring of diabetic parents may be underestimating the degree of concordance as T2DM typically appears later in life and the offspring may not manifest Diabetes Mellitus until after the parents have passed away. Spouses of patients with T2DM also have an increased risk of glucose intolerance and risk of developing T2DM, thus they should also be classified as high risk for developing T2DM (14).

Studies have also shown that family members living together tend to adopt similar lifestyle habits (15) which predispose them to develop T2DM. This clearly demonstrates the pivotal role of lifestyle modification among family members to prevent T2DM (16).

1.1.4 Prevention of Type 2 Diabetes Mellitus

Given the substantial morbidity and mortality associated with T2DM, it therefore becomes an important public health issue and the medical fraternity is seeking ways to prevent or delay the onset of T2DM especially in high risk groups. One of the high risk groups of interest particularly in this study includes offspring of T2DM patients. Despite this knowledge along with significant advances in the understanding of the human genome, the prevalence of T2DM continues to rise exponentially globally. This then demands urgent preventative actions.

The time has now come to plan beyond improving health control of our patients, but to move towards expanding the scope of non-communicable disease prevention within the population targeting those at high risk. Preventive medicine activities such as promotion of healthy lifestyles and regular screening of high risk groups as well as early risk factor identification and modification should be practiced amongst health care workers. Early intervention to prevent T2DM confers benefits to patients in increasing life expectancy and quality of life, while potentially be cost saving to the economy (11, 17).

1.2 Problem statement

Commentators have thus called for a public health approach to prevention of T2DM, with particular emphasis on targeting individuals with a family history of Diabetes. In Malaysia, the National Strategic Plan for Non-Communicable Disease (NSP-NCD) was developed in 2010 by the Ministry of Health to tackle the increasing prevalence of non communicable diseases, particularly T2DM (7). The general objectives of the NSP-NCD are to either prevent or delay development of cardiovascular disease and

Diabetes, to improve management of the diseases thus leading to an enhanced quality of care. One of the targeted areas of NSP-NCD is clinical prevention and health promotion. This includes introducing preventive lifestyle intervention in the first degree relatives of individuals with a positive family history of T2DM as a means of preventing them from developing T2DM. However, implementing Diabetes prevention strategies and interventions in the general population even in high risk groups is expected to be challenging (18).

A starting point to making changes in the family on a smaller and modest scale is to encourage patients with Diabetes to become the health promoter within the family to talk about risk of Diabetes with their first degree family members (19) .It is hoped that they can subsequently be the intervention within the family to bring about change in the lifestyle of the family itself.

Therefore ascertaining risk perception of T2DM patients who have children is important prior to introducing preventive lifestyle intervention in that it may impact the willingness of family members to engage or accept preventive lifestyle intervention. Measuring risk perception of developing T2DM among the offspring of individuals with T2DM is also crucial to identify individuals who are willing to enrol in Diabetes Mellitus prevention strategies and whether these strategies will be accepted. However, to date, perception of T2DM patients regarding the risk of their first degree relatives developing T2DM has never been studied in the Malaysian context.

Whitford et al (2009) had previously studied risk perception and the willingness to accept preventive lifestyle intervention in patients with T2DM and their first degree relatives in Ireland (20). They developed two questionnaires to assess the

perceptions of T2DM patients and their first degree relatives concerning risk of developing T2DM in their family based on the parameters of the Health Belief Model (19, 21). These questionnaires were later named the Diabetes Mellitus in the Offspring Questionnaire (DMOQ) which assess the risk perception among T2DM patients, and the Diabetes Mellitus in the Offspring Questionnaire - Relatives (DMFQ-R) which assesses the risk perception among first degree relatives, including offspings of T2DM patients.

To our knowledge, there is currently no validated instrument in the Malay language that assesses the perceptions of T2DM patients on the risk of their offspring of developing T2DM and the possibility of intervention to reduce this risk. Therefore, this paucity of evidence gives rise to our research questions.

1.3 Research question

What is the validity and reliability of the translated DMOQ-Malay version to assess the perceptions of Malaysian T2DM patients about the risk of their offspring developing Diabetes Mellitus and the possibility of intervention to reduce this risk?

1.4 General Objectives

This study aimed 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 of the DMOQ.

1.5 Specific objectives

1) To adapt and translate the original DMOQ from the English language into the Malay language.
2) To determine the validity of the DMOQ Malay version.
3) To determine the reliability of the DMOQ Malay version

1.6 Research hypothesis

The hypotheses of this study were as follows:

1) The adapted and translated DMOQ in the Malay language will be as good as the DMOQ in the original English language.
2) The adapted and translated DMOQ in the Malay language will be valid.
3) The adapted and translated DMOQ in the Malay language will be reliable.

1.7 Significance of the study

Adapting and translating the DMOQ from the English language to the Malay language would produce a locally validated instrument that assesses the perception of T2DM patients regarding risk of their first degree family members of developing T2DM. This tool would have the advantage that it can be used widely within our local setting to provide a better understanding on matters related to risk perceptions and potential intervention to reduce this risk.

CHAPTER 2: LITERATURE REVIEW

2.1 The theoretical framework

The main conceptual framework to support this study is the integration of the Health Belief Model (HBM) and the Health Value Scale (HVS) to assess the perception of T2DM patients regarding the risk of their offspring in developing T2DM and the possibility of intervention to reduce this risk. The constructs underlying risk perception and the likelihood of taking preventative health actions in the HBM are summarised in Figure 3.1.

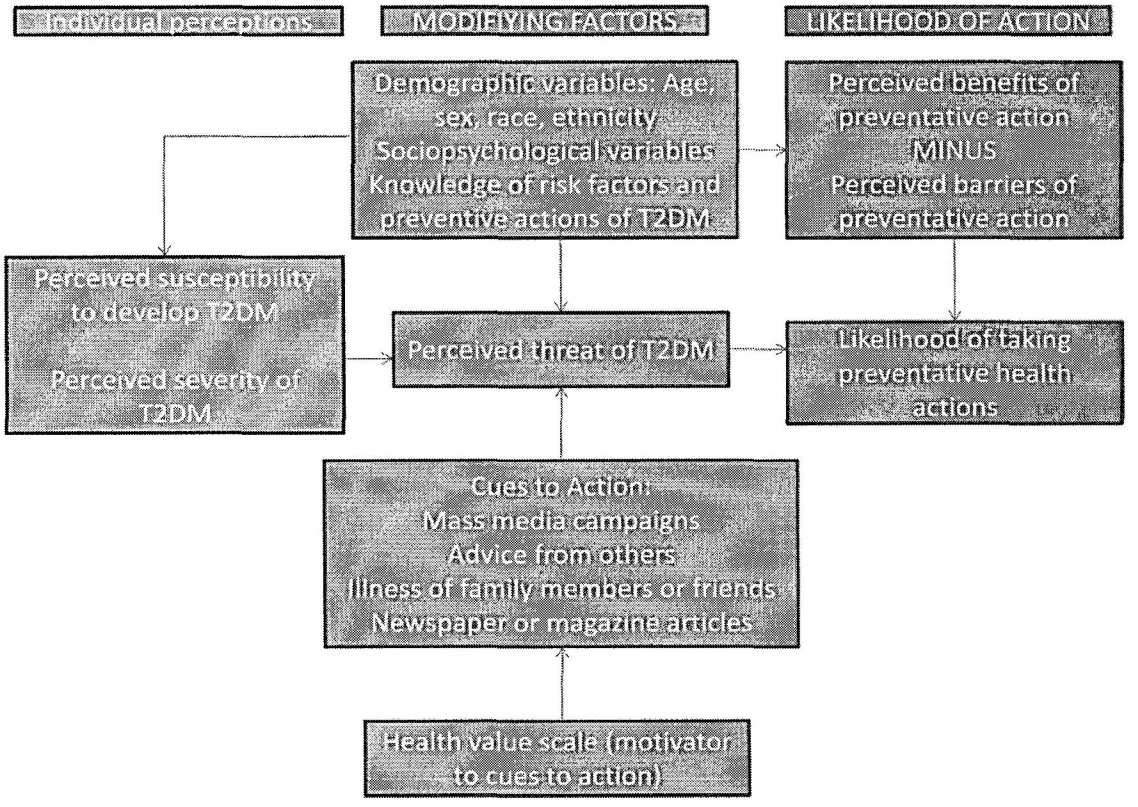


Figure 2.1: Basic elements of the Health Belief Model

The HBM has been used widely in many health contexts. The model was initially formulated to understand why individuals did or did not engage in health-related actions (22). This model postulates that health behaviour is determined by either personal beliefs or perceptions about the disease and the strategies that may be available to reduce the disease occurrence(22).

The main four constructs of the HBM include perceived susceptibility, perceived severity, perceived benefits and barriers. Perceived susceptibility refers to an individual's subjective perception of the risk of contracting an illness. Perceived severity of an illness refers to an individual's subjective perception of the severity of the illness being discussed. An individual would be expected to accept recommended health-related actions if it was perceived as feasible and efficacious, as examined by the construct of perceived benefits. Perceived barriers refer to the potential negative aspects of health-related actions which may act as obstacles to undertaking the recommended behaviour. More recently, other constructs have been added to the HBM including cues to action of preventive action (23), motivation and self-efficacy (24).

When these constructs were conceptualized in the context of health-related behaviour, the correspondences were: 1) the desire to avoid an illness, 2) the belief that a specific health action will prevent or delay an illness (i.e. the individual's estimate of threat of the illness, the likelihood of being able through personal action to reduce the threat) (22).

In the context of T2DM, the model attempts to identify factors likely to increase health-related actions undertaken by the patients and their families to bring about change in preventive behaviour aiming to reduce the risk of family members in developing T2DM. The likelihood that an individual will perform preventive health behaviour depends on their perception of the threat to developing T2DM and the perceived barriers and benefits of undertaking health-related actions. Individuals are then more likely to undertake preventive health behaviour that has many benefits and few barriers.

Another variable that has often been added to the Health Belief Model is the value an individual places on his or her health as it has previously been argued that some individuals may respond to certain cues of action due to the value they place on their health. Therefore, the Health Value Scale (25) was added into the theoretical framework of this questionnaire.

2.2 Definition of terms

2.2.1 Definition of risk perception

The concept of risk perception (perceived risk) which is also known as perceived probability, likelihood, susceptibility or vulnerability is a central construct of many health behaviour models addressing health-protective behaviours (26). This concept assumes that the higher the perceived threat or likelihood of developing a certain disease, the more likely an individual will modify his or her behaviour. This specific construct is usually assessed through self-report questions such as, "What is your chance of getting Diabetes Mellitus in the coming years?"

A number of factors influence disease threat which includes an individual's beliefs or perception of risk contracting a disease and its severity (16). It has been hypothesized that individuals will alter their behaviour only if they perceive themselves to be at risk of contracting Diabetes Mellitus and believe that they can take action or steps to prevent Diabetes Mellitus (18). Thus, addressing and altering risk perception is utmost important as a potential target.

One of the aspects of risk perception is actual risk versus perceived risk. An example can be given in the context of T2DM, in which an individual with a positive family history has a high risk of developing Diabetes Mellitus; however does not perceive him or herself to be at risk, then the individual might not have motivation to make lifestyle changes. On the other hand, it could be a T2DM parent who does not perceive their offspring to be at risk of developing Diabetes.

In the context of our interest, if a parent perceives their offspring to be at higher risk of developing Diabetes Mellitus, the theory then hypothesizes that they might have a higher motivation to speak to their family members regarding risk of Diabetes and how to prevent it. However, it is appreciated that the willingness to communicate about personal health care varies across different families. Evidence have shown that diabetic patients are less likely to communicate to their relatives about risk of Diabetes and risk-reducing activities if they themselves are not undertaking the behaviours themselves (19).

Families represent an ideal context for consideration of communication regarding risk perception and prevention of Diabetes because not only do they develop behavioural

norms, but direct influence might be employed based on family roles such as between a parent and an offspring (27). Thus, increasing communication within the family in an effort to reach offspring might allow interventions aimed to reduce T2DM risk, however, little is known regarding how best to do this.

Pierce et al (28) examined 159 parents to see whether parents perceived their children to be at risk of developing T2DM. Almost as many as 64% of parents underestimated the risk that their offspring might develop T2DM. Although 44% thought it was possible to reduce the risk of T2DM and its complications; little was known about prevention. The authors concluded that education and counselling about risk and prevention are needed.

Whitford et al (19) aimed to assess communication of familial risk by patients with T2DM to their first degree relatives including siblings and offspring. This study found that 65% had already taken the initiative without formal prompting of speaking to their first degree relatives regarding risk of Diabetes. Interestingly, the findings from this study found greater awareness of diabetic patients towards relatives compared to previous studies. The conclusion is that discussion of risk and preventative interventions should be widely encouraged within the family.

In a study by Myers et al (27), the authors aimed to describe the communication that occurs in families between diabetic patients and their non diabetic relatives. The study found that conversations among family members with and without T2DM mainly focused on symptoms and disease management. It was noted that in communication with family members without Diabetes, there was lack of perceived relevance which

was a huge barrier in communication of familial risk. Diabetic patients have been recommended to communicate Diabetes risk and education to their high risk family members to increase their awareness of the risk, followed by shared learning with others.

Pijl et al (29) conducted a study assessing the potential effectiveness of communicating familial risk of Diabetes versus general health information on Diabetes to individuals with a positive family history of Diabetes. The study found that individuals who had received familial risk information were more likely to exhibit improved self-reported behaviour outcomes at three months compared to the individuals receiving general risk information. Although in a previous study by Kinmoth et al (30) found that a theory-based intervention which aimed at increasing exercise in relatives of T2DM patients was no more effective compared to a leaflet with exercise advice, it seems promising that this study had shown positive outcomes following communication of familial risk.

In a more recent study, Whitford et al (21) aimed to establish whether first degree relatives of a diabetic patient would accept them as health promoters to intervene in their families as a means of prevention of Diabetes. This study found that 94% of first degree family members (siblings and children) would like to be spoken to about their risk of Diabetes. Interestingly, a little more than half of the subjects have already been spoken to by their family members with Diabetes and reported higher risk perception of Diabetes.

It is therefore crucial to identify diabetic patients who can facilitate communication, education, and modelling of healthy behaviours to increase awareness and motivate family members to adopt risk-reducing behaviours (27).

On the other side of the coin, many more studies have been conducted assessing relatives' views and risk perceptions of Diabetes. Pierce et al (31) explored regarding risk perceptions in offspring that had at least one parent with Diabetes Mellitus. The study found that offspring of diabetic parents are usually aware that they have an increased risk of developing Diabetes Mellitus, however this risk is usually underestimated and they know little about preventive strategies.

2.2.2 Definition of preventive lifestyle intervention

The reason why communication within the family regarding risk perception of Diabetes and its prevention is important is because evidence has shown that lifestyle intervention targeting high risk groups of developing Diabetes Mellitus is highly successful. Good communication leads to an increased awareness of risk perception which will motivate risk-reducing behaviours within relatives at risk of developing Diabetes Mellitus.

Most studies looking at prevention of T2DM have targeted interventions aimed at achieving and also maintaining a healthy body weight via dietary measures and physical activity or a combination of both (11).There is evidence that interventions at the population level including dietary modification, exercise and weight loss are effective at reducing the proportion of individuals subsequently developing T2DM (16).

The Finnish Diabetes Prevention Study (DPS) was the first randomized controlled trial looking at the effects of lifestyle intervention in preventing development of T2DM (32). This trial randomized 522 middle aged, overweight subjects who had impaired

glucose tolerance to either a usual care control group or an intensive lifestyle intervention group. The control group were given general dietary and advice on exercise at baseline and underwent an annual physician's examination. On the other arm of the trial, the intervention group received an additional individualized dietary counselling from a trained nutritionist. This group also underwent circuit-type resistance training. The outcome of the trial showed that there was significantly greater improvement of glycaemia and lipaemia in the intervention group. The trial concluded that intensive lifestyle intervention produced long term benefits in diet, physical activity, clinical and biochemical parameters which in turn reduced Diabetes risk.

Another randomized control trial and one of the largest to be carried out was the Diabetes Prevention Program (DPP) (33). This clinical trial set out to examine whether lifestyle intervention or pharmacological therapy (metformin) would prevent or delay the onset of Diabetes Mellitus in 1079 participants who had impaired glucose tolerance compared to a placebo control group. The two major goals of the lifestyle interventions in this trial were a minimum of 7% weight loss/weight maintenance and a minimum of 150 minutes of moderate intensity physical activity. This trial found that both lifestyle interventions and metformin prevented development of T2DM and restored normoglycaemia. However, it was noted that lifestyle interventions were more effective compared to metformin especially in older adults and also had the advantage of a lower mortality rate compared to the metformin arm.

The Indian Diabetes Prevention Programme (IDPP) (34) was a prospective community based study testing whether the progression to Diabetes Mellitus could be influenced by interventions in native Asian Indians who were younger, leaner and

more insulin resistant than the previously studied American, Finnish and Chinese populations. 531 subjects were randomized into four arms. Arm 1 was the control group. Arm 2 received advice on lifestyle modifications (LSM). Arm 3 was treated with metformin (MTF) and Arm 4 was given both lifestyle advice and metformin (LSM + MTF). The trial found that progression of impaired glucose tolerance was high in native Asian Indians. The relative risk reductions were 28.5% with LSM, 26.4% with MTF, and 28.2% with LSM + MTF, compared to the control group. The authors concluded that both LSM and MTF significantly reduced the incidence of Diabetes Mellitus, however there was no added benefit found of combining both LSM and metformin.

These trials have proven the fact that lifestyle interventions are pivotal in the prevention of T2DM. However, one of the questions that arise from this evidence is whether family-based intervention would be acceptable among the high risk first degree relatives in Malaysia using the T2DM patient as health educators to promote healthy behaviours in the family.

2.3 Questionnaires measuring risk perception of patients towards their family members developing Diabetes Mellitus

One of the earliest researcher to develop a questionnaire assessing risk perception of T2DM patients towards their family members in developing Diabetes Mellitus was Pierce et al in 1999 (28). The questionnaire developed by this team of researchers aimed to assess beliefs and concerns of T2DM patients about their offspring's risk of developing Diabetes Mellitus. It included questions on demographic details, perceptions of their children's risk of developing Diabetes, anxiety of their children developing Diabetes and ideas for prevention.

Nishigaki et al (35) designed a self-administered questionnaire to assess the perceptions of T2DM patients regarding risk of Diabetes in their offspring, as well as a separate questionnaire for offspring of these T2DM patients to assess their own perceptions of risk of developing T2DM. The perception of offspring risk for developing T2DM was assessed among the T2DM patients as "the likelihood of your offspring developing Diabetes in comparison to the general Japanese population". The likelihood was evaluated from three perspectives which were risk due to current lifestyle, risk due to family history and also overall risk of developing Diabetes compared to the general Japanese population.

The DMOQ was developed by Whitford et al (19) in 2009. It aimed to assess diabetic patients' beliefs and actions regarding discussion of T2DM with their first degree relatives. The DMOQ was developed, piloted and refined based on the underlying concept of the Health Belief Model (HBM) (22) as the theoretical framework. This questionnaire was chosen in this study compared to the other questionnaires as the strength of the DMOQ is due to its underlying fundamental theoretical framework which is based on the Health Belief Model in the design of the questionnaire. This ensures the parameters or constructs likely to influence the adoption of preventive health behaviour were addressed.

Walker et al developed The Risk Perception Survey-Developing Diabetes (RPS-DD) in 2003 which is a 43-item survey in the English language administered for individuals who are at risk of developing T2DM (36).The questionnaire assesses an individual's comparative risk perceptions for developing Diabetes and/or its complications, as well as their environmental perceived risks. However, this particular risk perception

survey is intended to be administered to individuals at risk of developing Diabetes and not to the diabetic patients themselves to assess risk perception of their relatives.

2.4 Diabetes Mellitus in the offspring questionnaire (DMOQ)

The DMOQ includes the four main constructs of the HBM including perceived susceptibility, perceived seriousness, perceived benefits and barriers. Other constructs have also been added to the DMOQ which includes cues to action, motivation to cues to action as well as the Health Value Scale.

Questions on perceived susceptibility included perceptions of family risk and anxiety of developing Diabetes amongst first degree family members and were adapted from previous studies by Pierce et al in 1999 and 2001 (31, 37), as were the questions on perceived seriousness which was derived from a study by Singh et al in 1994 (38). Themes for the questions on perceived benefits and barriers as well cues to actions were identified from focus groups attended by T2DM patients. The validated Health Value Scale by Lau et al in 1986 (39) was also included into this questionnaire to assess health value as a possible motivator to an individual for adopting preventive health behaviour.

The Cronbach alpha values for internal reliability for the scales of the Health Belief Model in the original DMOQ questionnaire were (40): perceived severity 0.45; perceived susceptibility 0.72, perceived benefits 0.88, perceived barriers 0.71, cues to action 0.67 and health value scale 0.72.The DMOQ has also been translated into the Arabic language, however, the psychometric analyses of the Arabic version were not published (40).

2.5 Evaluation of Health Status Questionnaires

There is currently great emphasis on using standardized and validated questionnaires to measure health status or outcomes due to the assumption that it enables comparison of results across studies both nationally and internationally (41).The number of health status questionnaires that are currently available has increased in number over the past decade or so. Therefore, choosing a particular questionnaire to use becomes difficult. Thus, a criteria or a guideline is required to determine the methodological quality of studies developing and evaluating health status questionnaires albeit similar to systematic reviews of clinical trials. The criteria should aim to guide development of design, methods and outcome of studies on the development and evaluation of health status questionnaires.

Among the criteria that have been developed, the best known and comprehensive criteria are those from the Scientific Advisory Committee (SAC) of the Medical Outcomes Trust (42). This criteria outlined eight attributes of instrument properties that merits consideration of evaluation including 1) conceptual and modelling model, 2) validity, 3) reliability, 4) responsiveness, 5) interpretability, 6) respondent and administrative burden, 7) alternative forms, and 8) cultural and language adaptations (translations). Within each attribute, further specific criteria were outlined by which the health status questionnaires should be reviewed.

Trewee et al (43) further discussed and refined the available criteria for the studies on development and evaluation of health status questionnaires, including the following measurement properties; 1) content validity, 2) internal consistency, 3) criterion validity, 4) construct validity, 5) reproducibility, 6) responsiveness, 7) floor and ceiling effects, and 8) interpretability. These criteria also aimed to be used to detect gaps or

shortcomings in knowledge of measurement properties and to also help design future validation studies. The following table 3.1 explains the definition of the measurement properties:

Table 2.1: Definition of measurement properties

Measurement property	Definition
1. Content validity	The extent to which the concepts of interest are comprehensively represented by the items in the questionnaire.
2. Internal consistency	The extent to which items in a questionnaire (sub)scale are correlated, thus measuring the same concept.
3. Criterion validity	The extent to which scores on a particular instrument relate to a gold standard.
4. Construct validity	The extent to which scores on a particular instrument relate to other measures in a manner that is consistent with theoretically derived hypotheses concerning the concepts that are being measured.
5. Reproducibility	The degree to which repeated measurements in stable persons (test-retest) provide similar answers. 5.1 Agreement concerns the absolute measurement error i.e., how close the scores were on repeated measurements. 5.2 Reliability concerns the degree to which patients can be distinguished from each other, despite measurement error.
6. Responsiveness	The ability of a questionnaire to detect clinically important changes over time, even if the changes are small.
7. Floor or ceiling effects	Considered to be present if more than 15% of respondents achieved the lowest or highest possible score, respectively.
8. Interpretability	The degree to which one can assign qualitative meaning to quantitative scores.

2.6 Cross-cultural adaptation and translation of an instrument

As the population increases in diversity, it becomes more important to conduct health research within non English speaking populations. Research questionnaires may not always be translated appropriately for use in the target population in a new linguistic or cultural setting (41). The concern that arises is that the results based on these instruments might therefore not accurately reflect what the instruments are meant to measure.

There is agreement that it is inappropriate to simply translate a questionnaire and use it in another linguistic context (44) without undergoing the recommended cross cultural adaptation guideline. The cross-cultural adaptation process is extremely important when an instrument is used in a different language, setting and time to reduce the risk of introduction of bias into a study (44).

A previously validated instrument does not necessarily mean that it is valid in another time, place, culture and context. Therefore, a concern arises if the health status questionnaires are not translated appropriately prior to being used in a new cultural or linguistic setting, thus the results based on such instruments may not accurately reflect what they are supposed to measure (41). Thus, this emphasizes the importance of a proper cross cultural adaptation of an instrument to ensure that the concepts within an instrument are equal between the original and the translated questionnaire, in terms of time and context (44). There are many guidelines outlining the process of cross-cultural adaptation and translation of a questionnaire (41, 44-46).

The preparatory stage which involves the initial work carried out before the adaptation and translation work begins is recognized as an important step to begin the study process (45). As part of the preparatory stage, permission from the original questionnaire developer should be obtained prior to the adaptation and translation process. The rationale behind this is to respect the copyright of the original questionnaire as there is a risk of being prosecuted if found to have unauthorized use of copyright material.

The next step is to carry out the investigation of conceptual and item equivalence through the process of content validation. Content validity is considered as the most important measurement property. Only if the content of the questionnaire is valid and sound, will one consider adapting and translating the questionnaire. Content validation process is meant to assess whether there is similar relationship between the questionnaire and the underlying concepts in both the original and target setting (44). Both the conceptual and item equivalence can be assessed through a thorough literature review and these findings should then be discussed amongst the expert committee to clearly define the conceptual framework (44).

Conceptual equivalence is a process to investigate which domains are important to the concept in the target population and its culture and the relationships between them (44). Investigating conceptual equivalence essentially involves exploring the ways in which different populations conceptualize health and quality of life and the values they place on different domains of health and duality of life. Conceptual equivalence is achieved when the questionnaire has the relationship to the underlying concept in both cultures of the source and target population.

An initial assessment of the conceptual equivalence of health and quality of life in the source and target population involves examining the nature of the concept being examined in both cultures. This can be achieved through a thorough literature review. In the target population, there is a range of potential research approaches to establishing local perceptions of the concepts examined including local literature review and consulting experts in the target culture (44).

Item equivalence concerns the way in which domains are sampled as relevance of the domains in the questionnaire may vary across cultures (44). Item equivalence exists when items estimate the same parameters on the trait being measured and when they are equally relevant and acceptable in both cultures. This can be achieved through a literature review as well as via discussion with an expert panel.

Semantic equivalence is concerned with the transfer of meaning across languages and whether it will achieve a similar effect on participants in different languages (44). One of the most important aspects of meaning is ensuring that the level of language used is appropriate to the needs of the target population. Prior to any translation process, it is important that key words or expressions within the questionnaire should be clearly understood by the translators. Establishing the meaning of items, words or phrases in the source language is one of the most common problems faced during a translation process.

According to the guidelines, the original instrument should be translated from the original language into the language of the target population (forward translation) by at least two persons independently by translators who are fluent in the language of the

target population with a good understanding of the original language (44, 46). The selection of competent translators is extremely crucial to ensure that the research instrument is effectively adapted and translated into the target language. It has been agreed upon that all forward translators should be native speakers of the target language as they have the advantages with language ability compared to second language speakers (45).There is also a general agreement in most existing guidelines regarding the need for more than one forward translators (45). The rationale behind this is so that the translations can be compared, enabling detection of errors and divergent interpretation of any ambiguous items in the original questionnaire, therefore reducing the potential bias of each forward translator. Additionally, more than one translation will reduce the risk of a single translation that has too much of one person's own style of writing. There have also been previous discussions with regards to the qualifications required for the people chosen to carry out the forward translations.

Following the forward translation process, the process of reconciliation takes place to produce a synthesized forward translation version. In the existing guidelines, there are many approaches about how this reconciliation should be carried out. The three approaches are namely (45):

1) A translation panel consisting of the primary researcher and all forward translators;
2) An independent native speaker of the target language who was not involved in any of the forward translations;
3) An appointed investigator who may have prepared one of the forward translations; who will also conduct the pilot testing and cognitive debriefing.

The preferable approach is approach number 1 as most importantly, reconciliation decisions should be reviewed with the primary researchers to allow a degree of consistency and harmonization with other translated versions(45). The process of reconciliation aimed to resolve discrepancies between the original independent translations, and seeks agreement between individual speech habits, writing style and preferences

The synthesized forward translation version then undergoes backward translation. The primary purpose of back translations was to provide a quality-control step to demonstrate that the quality of the translation is such that the same meaning can be derived when the translations is moved back to the original source language of the questionnaire.

The next step is then the harmonization process which involves harmonization of all new translations with each other and the original source version of the DMOQ. Harmonization was a key objective of the process of translation and cultural adaptation (45). The rationale of this important step in the study process was to detect any translation discrepancies that may arise between different language versions; therefore ensuring conceptual equivalence is maintained between the source and target language versions.

Face validation is the process of determining whether the adapted and translated questionnaire is appropriate to the study purpose and content area. The process of face validation is important to assess the level of comprehensibility and cognitive equivalence of the adapted and translated questionnaire on the target population

(41). It may also highlight any items on the questionnaire that may be inappropriate at a conceptual level and also to identify any other issues that may give rise to confusion. It is the easiest validation process to be undertaken, however is the weakest form of validity (47).This process also allowed testing of any translation alternatives that have not been resolved by the translators. It is also important at this stage to highlight any inappropriate items at a conceptual level and to also identify any issues that might give rise to confusion. There were no criteria on how to reach certain decisions such as adjustment or retaining of items. This was based solely on the subjective judgement of the researchers. Unclear words and sentences identified from the face validation were adjusted accordingly. Respondents are probed for their understanding, acceptability and emotional impact of the items in the questionnaire to detect any confusing or misleading items (46).

Before the adapted and translated instrument can be administered to participants in the field testing for its psychometric properties, the last important step is to determine the operational equivalence of the questionnaire. This aspect should be evaluated after the semantic adjustments have been made (41). Operational equivalence looks at whether it is possible to use similar questionnaire format, instructions, mode of administration and measurement methods that was used in the original setting in the target population (44). This information is derived from a thorough literature review and also from discussions with experts in the field and members from the target population. Once a consensus is reached, the methods are incorporated into the study process to produce the harmonised questionnaire, which is now ready for field testing and analysis of its psychometric properties (46). Figure 5.1 shows the model for assessing cross-cultural equivalence in health and quality of life questionnaires by M. Herdman et al (44). It also shows the order in which the different types of equivalence should be tested.

Sample size is a key parameter for the planning of a study in clinical research, however not many guidelines go in detail regarding this component to help researchers assess the psychometric properties of a questionnaire with patient reported outcome measures. Although an inappropriate sample size may lead to flawed findings in many aspects of questionnaire development or validation, no consensus exists to define sample size with the same rigidity as found in other studies based on clinical or biological criteria (48).

There are currently varying opinions and rules of thumb cited in the literature with regards to sample size estimation for validation studies. The widely accepted methods include arbitrary determined sample sizes, subject to item ratio and sample size determination dependent upon the stability of solution via the Kaiser-Meyer-Olkin measure of sampling adequacy of the Bartlett's test of sphericity (49). Arbitrary determined sample sizes adequate for factor analysis have been cited in the literature as a sample size as low as 50 participants or even up to 300 participants (50).

Determination of sample size sufficiency conditional upon the strength of the factors and items to determine adequacy of a sample can only be determined until the analysis has been conducted (50). This provides a new criterion operationalizing these relationships in which for example, if the factors have four or more items with loadings of 0.60 or higher, then the size of the sample is not relevant. If the factors have 10 to 12 items that load moderately (0.40 or higher), then a sample size of 150 or more is needed to be able to be confident in the outcome. If the factors are defined with few variables and have moderate to low loadings, then a sample of at least 300 participants is required as a sample size.

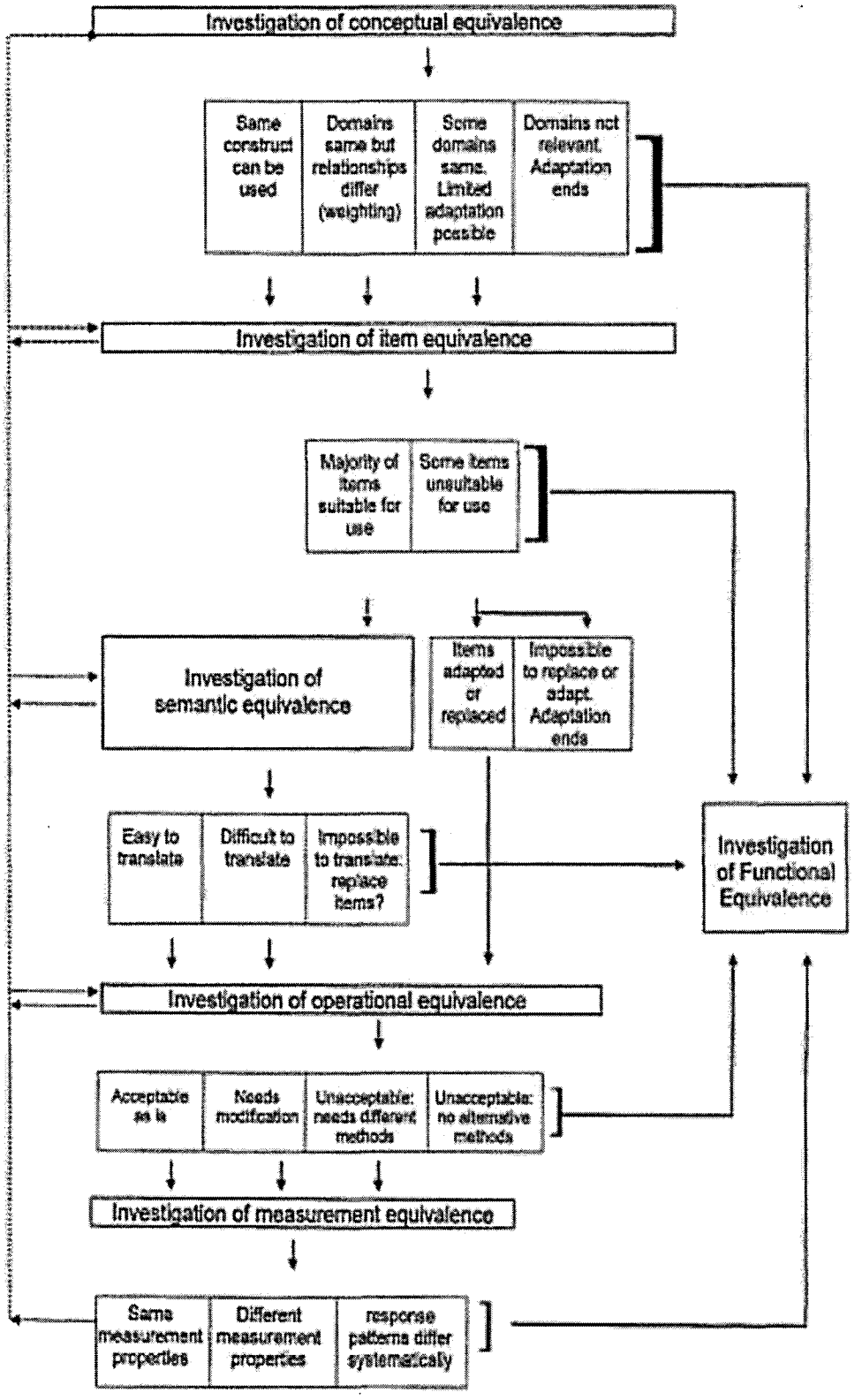


Figure 2.2 Model for assessing cross cultural equivalence in HRQoL questionnaires

2.7 Psychometric analysis

2.7.1 Construct validity

Construct validity refers to the degree in which the items on an instrument relate to the underlying theoretical framework (51). Construct validity should be assessed by testing predefined specific hypotheses, for example about expected correlations between measures (43). It is a quantitative value rather than a qualitative distinction between 'valid' and 'invalid' (47).

When the variable consists of multiple items or is known as a multidimensional instrument such as the DMOQ, factor analysis is subsequently used to determine the construct validity. A factor is a list of items that belong together (47). Factor analysis is a statistical method that is commonly used during development of an instrument to cluster items into a common factor, to interpret each factor according to the items having a high factor loading and summarising the items into a small number of factors (52). There are two types of factor analysis namely exploratory factor analysis (EFA) and confirmatory factor analysis (CFA).

EFA is a particular factor analysis method that examines the relationships among variables without determining a particular hypothetical model (52). This method of analysis helps researchers define the constructs based on the theoretical framework subsequently indicating the direction of the measure (51). By performing the EFA, the underlying factor structure was identified. Factor loadings refer to the measure of association between a particular item and a factor (52), related items make up the part of the construct that can be grouped together (47).

CFA on the other hand is a statistical technique that verifies the factor structure of a set of observed variables (53). CFA allows the researcher to test the hypothesis that a relationship exists between observed variables and the underlying latent constructs. The researcher may use knowledge of the theory, empirical research or the both of them to postulate a relationship pattern or a priori and subsequently tests the hypothesis statistically (53). CFA relies on several statistical tests to determine the adequacy of model fit to the data. There are a few similarities between the CFA and EFA including 1) both techniques are based on linear statistical models, 2) statistical tests associated with both methods are valid if certain assumptions are met, 3) both techniques assume a normal distribution and 4) both incorporate measured variables and latent constructs (53).

The extraction and rotational process in EFA maximises high item loadings while minimizing low item loadings, thus producing a more simplified and interpretable solution (49). There are two common types of rotation techniques which are orthogonal rotation and oblique rotation. Examples of orthogonal rotation methods include varimax or quartimax. Olbimin and promax on the other hand are examples of oblique rotation methods. Orthogonal rotation methods produce factor structures that are uncorrelated, whilst oblique rotation produces factors that are correlated. Oblique rotation methods give more accurate results in research involving human behaviours or when data does not meet priori assumptions (54). Varimax which is the most commonly used orthogonal rotation was used in this study to rotate the factors.

The rotated factor solution or matrix is useful to examine and further refine the factors. The items should possess significant factor loadings indicating a statistically valuable contribution. If an item is not significantly correlated to any of the factors

(generally a factor loading of less than 0.40), the item should be removed (50). Once this has been assessed, the researcher can then examine which items that do not load or are unable to be assigned to a particular factor and thus make a decision of whether any items should be discarded (49). Discarded items may include those items that might load on several factors, do not load on any factors, or simply not conceptually fit any logical factor structure (49).

The last process of the EFA is interpretation which involves examining which variables were attributable to a factor and giving that factor a name, theme or concept (49). The reason for a thorough and systematic factor analyses process is to isolate item with high loadings in resultant pattern matrices that explain the majority of responses (49). Interpretation of the factor requires each factor to be sufficiently identified (50).

Every step of the process in the factor analysis requires the researcher to have a firm understanding of the contextual theory and fundamental knowledge of the factor analysis methodology (50). This is important in this research as decisions made during the construct validity process should be supported by strong theoretical and mathematical justification, in order to ensure credibility to the final outcome of the translated and adapted questionnaires.

2.7.2 Reliability analysis

Reliability refers to the ability of the questionnaire to consistently measure an attribute and to see how well the items fit together in concept (51). In other words it means that reliability is the degree to which an assessment tool is examined whether to

determine if it is able to produce stable and consistent results. Although reliability of an instrument is necessary, reliability on its own is not enough to validate an instrument as the instrument may be reliable but not necessarily valid (51). There are three methods of examining reliability of a new instrument which includes Spearman rank *correlation coefficient, internal consistency reliability and test-retest reliability.* For this study, we conducted analysis of internal consistency and test-retest reliability.

Internal consistency examines inter-item correlation of a questionnaire and assesses how well the items fit together conceptually (51). A low Cronbach alpha indicates lack of correlation between the items in the scale, which then makes summarizing the items unjustified while a very high Cronbach alpha indicates high correlations among the items which means there may redundancy of one or more of the items (43).

The intraclass correlation (ICC) was used as a measure of association in the test-retest reliability analysis. It assesses the consistency or conformity of measurements made by multiple observers measuring the same quantity (55).

At the current time, there is no definite evidence about the best time interval to allow between the test and retest questionnaire administration. Factors such as the effects of time on health status such as deterioration or improvement in health should be considered by researchers to make the appropriate decision about the time interval between the test and retest questionnaires. The duration between the two tests then become critical as a shorter interval between the two tests will give a higher correlation where as a longer time lapse may lead to a lower correlation. The time

interval should be long enough that participants are not able to remember their previous responses, but not long enough for their knowledge of the material to have changed, thus 2 weeks to one month is the generally accepted time interval for retesting (56).

CHAPTER 3: METHODOLOGY

This chapter discusses the research methodology of this study and outlines the study design, study sampling, sample size, study tools, data collection, ethical approval, statistical analyses and working definitions that were employed.

3.1 Study design

This study was a cross sectional questionnaire validation study. This particular study design is a well known and acceptable design to achieve the purpose of this study (57).

3.2 Study population

The target population for this study was T2DM patients who were receiving care in the primary care setting.

3.3 Inclusion and exclusion criteria

3.3.1 Inclusion criteria

T2DM patients aged ≥ 18 years old who:

1) have at least one child/offspring that does not have T2DM
2) were able to speak and understand the Malay language

3.3.2 Exclusion criteria

1) Patients with Type 1 Diabetes Mellitus

2) Patients who were pregnant or have gestational Diabetes Mellitus
3) Patients with mental disorders associated with a loss of sense of reality (schizophrenia, bipolar disorder, Alzheimer's disease, psychosis or dementia).
4) Patients with any visual impairment that may impede them from completing the self-administered questionnaires.
5) Patients who did not have a good understanding and command of the Malay language.
6) Patients who did not give informed consent.

3.4 Sample size estimation

3.4.1 Sample size for face validation

Each set of guidelines differs in terms of the number of the participants that should be involved in a face validation (41, 46-48). The recommended number of participants of the target population to be recruited for face validation ranges from 5 to 40 participants. For this study, 20 T2DM patients from the NCD unit of KKSB who fulfilled the inclusion and exclusion criteria were recruited for the face validation.

3.4.2 Sample size for field testing

Sample size for field testing of the questionnaire was calculated using the subject to item ratio or also known as sample to variable ratio (SVR). It is a term coined to define how many participants are required for each variable or an item of the questionnaire, often denoted as *N:p* ratio where *N* refers to the number of participants and *p* refers to the number of variables of the questionnaire. The rule of thumb then recommends the subject to item ratio of between 3:1 to 20:1 (58). For this study, a

subject to item ratio of 5:1 was used. As there were 31 variables retained within the questionnaire after the process of content validity, the minimum required sample estimated was 155 participants. Taking into consideration of a 20% non-responder and non-eligibility rate, this study aimed to approach194 participants.

3.5 Sampling

3.5.1 Sampling frame

The sampling frame was the T2DM patients registered with the Non-Communicable Diseases (NCD) unit at Klinik Kesihatan Sungai Buloh (KKSB) who fulfilled the inclusion and exclusion criteria. This clinic was selected as it is located in a semi urban area and is a Type 3 facility serving up to 300-500 patients a day. The majority of patients attending this clinic are Malays (66.7%), followed by Indians (15.1%) and Chinese (7.9 %). KKSB has an NCD unit that runs on a daily basis providing a good pool of patients as a sampling frame for this study.

3.5.2 Sampling technique

Convenience sampling method was used to recruit T2DM patients who fulfilled both the inclusion and exclusion criteria from the NCD clinics at KKSB. This sampling method was used to recruit participants for face validation as well as for the field testing. Details of the sampling are described in the 'data collection' section. Convenience sampling method was adopted due to the time constraint to conduct this study.

3.6 Study tool

The study tool was the Diabetes Mellitus in the offspring questionnaire (DMOQ) (Appendix 1), developed in 2009 by Whitford et al (59) based on the parameters of the Health Belief Model. It contained 34 items and seven concepts. The aim of this questionnaire was to assess the perception of patients with T2DM concerning perceived risk of their first degree family members in developing T2DM and the possibility of prevention of T2DM in their family. Table 4.1 below depicts the concepts and its items within the original DMOQ.

Table 3.1: Concept and items of the original DMOQ

No	Concept	Item(s)	Response	Measurement	Scoring
1	Knowledge of Diabetes risk factors	7 items	Multi-choice question	Assesses the patients' knowledge of risk factors of Diabetes Mellitus.	All answers apart from 'Don't know' and number 3 are correct. The more answers ticked, the higher the knowledge of the participant of risks of T2DM.
	Knowledge of risk reduction of Diabetes Mellitus	1 item	Subjective answer	Assesses the patient's knowledge of risk reduction of Diabetes Mellitus in relatives.	
2	Perceived susceptibility	5 items	4 point Likert scale 1= Not at all likely 2= Not very likely 3= Quite likely 4= Very likely	Assesses perceptions of family risk of Diabetes Mellitus and anxiety about developing the disease in the family.	Minimum = 5 Maximum = 20 The higher the score, the higher the perceived susceptibility of T2DM patients of their relatives developing T2DM.
3	Cues to action	2 items	None/Some/All	Assesses whether patients are likely to intervene in their families as the cue to action.	
	Cues to action	1 item	6 point Likert scale 1= Strongly disagree 2= Moderately disagree 3= Slightly disagree 4= Slightly agree 5= Moderately agree 6= Strongly agree		Minimum = 1 Maximum = 6 The higher the score, the higher the acceptance of training for willingness to speak to family members amongst T2DM patients.

No	Concept	Item(s)	Response	Measurement	Scoring
	Motivation to cues to action	1 item	Subjective answer	Assesses motivation to cues to action	
4	Perceived benefits	3 items	6 point Likert scale 1= Strongly disagree 2= Moderately disagree 3= Slightly disagree 4= Slightly agree 5= Moderately agree 6= Strongly agree	Assesses the patients perceived benefits of speaking to their relatives about risk reduction of developing T2DM.	Minimum=3 Maximum=18 A score of 3 means that the patient strongly disagrees about the perceived benefits of speaking to their relatives. The higher the score, the higher the patient perceives the benefits of speaking to their relatives about risk reduction of developing T2DM.
5	Perceived barriers	5 items	6 point Likert scale 1= Strongly disagree 2= Moderately disagree 3= Slightly disagree 4= Slightly agree 5= Moderately agree 6= Strongly agree	Assesses the patients perceived barriers to speaking to their relatives about risk reduction of developing T2DM.	Minimum=5 Maximum=30 A score of 5 means that the patient strongly disagrees about the perceived barriers to speaking to their relatives as stated. The higher the score, the more the patient agrees to the perceived barriers given.

No	Concept	Item(s)	Response	Measurement	Scoring
6	Perceived severity	5 items	4 point Likert scale 1=Not serious 2=Mildly serious 3=Quite serious 4=Serious 5=Very serious	Assesses patients' perception of the severity of Diabetes compared to cancer, flu, AIDS and arthritis.	For each of the disease, the score: Minimum=1 Maximum=5 The higher the score, the higher is the perceived severity of the disease
7	Health Value Scale	4 items	7 point Likert scale 1=Strongly agree 2=Moderately agree 3=Mildly agree 4= Agree 5= Mildly disagree 6= Moderately disagree 7= Strongly disagree	Assesses the value placed on health as a possible motivator of preventive health behavior.	Item 1 and 3: The lower the score, the higher the patient values health as a possible motivator of preventive health behaviour. Item 2 and 4: The higher the score, the more the value placed on health as a possible motivator of preventive behaviour.

3.7 Conduct of the study

This study was conducted in three phases as follows:

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

Phase 3: Field testing and psychometric analysis of the DMOQ Malay version

3.7.1 Phase 1: Adaptation and translation of the DMOQ from English into the Malay language

3.7.1.1 Preparatory stage

Permission from the author of the original questionnaire, Prof David L. Whitford was obtained for the instrument to be translated, adapted and validated in the Malay language (Appendix 2). He was also invited to be involved in the study process, specifically in the translation process as he was able to clarify the concept behind the themes and also to clarify any ambiguities that would have arisen. This step was crucial to avoid misinterpretation of items or concepts within the questionnaire.

At this stage, discussion regarding the name of the questionnaire was also made with the author. It was agreed that the questionnaire was named the Diabetes Mellitus in the offspring questionnaire (DMOQ) for ease of reference throughout the study and also in future clinical practice. This name was chosen based on an earlier version of a questionnaire by Pierce et al in 1999 (28) which formed the basis of the current questionnaire.

3.7.1.2 Content validation and adaptation

A team of four experts in the field of Diabetes Mellitus and questionnaire design reviewed the original 34-item DMOQ English version for conceptual and item equivalence. Seven main concepts were identified within the study instrument. The identified concepts were 1) knowledge of risk factors and risk reduction of T2DM, 2) perceived susceptibility, 3) cues to action, 4) perceived benefits, 5) perceived barriers, 6) perceived severity and 7) health value scale. Once the conceptual framework was established, each reviewer independently rated the relevance of each item to the conceptual framework to ascertain whether the contents of the questionnaire were appropriate and relevant to the meet the study's objectives and purpose.

3.7.1.3 Forward and back-translations

The 31-item DMOQ was then translated word for word from the English language to the Malay language by two translators to produce the M1 and M2 versions. One of the translators was a health professional and the other translator was a linguistic expert. Both translators were fluent in the Malay language and had good command of the English language. Each forward translator was provided with background information about the conceptual basis of the measures within the questionnaire to reduce lack of conceptual equivalence in the translations. Instructions were given to the translators to produce colloquial translations that would be easily understood by the general lay persons. They were also advised to report any difficulties or ambiguous terms encountered during the forward translation of the DMOQ to the primary researcher. The next step of the process was the reconciliation of the M1 and M2 versions to produce a single synthesized translated version named the M-S version.

The synthesized M-S version was then back translated into the English language by two independent back translators to produce the E1 and E2 versions. One of the translators was a health professional and the other translator was a linguistic expert. Both the translators did not have English as a native language; however they had lived and studied in the United Kingdom for up to 8 years. A review of the E1 and E2 versions against the source language was carried out by the research team to ensure conceptual equivalence of the translations to identify any discrepancies. The author of the original questionnaire was contacted at this stage to resolve any ambiguity or difficult issues. Both E1 and E2 versions were then synthesized into the E-S version.

Finally, the original DMOQ English version, the translated Malay versions, and the back translations were reviewed by the research team along with the translators in the harmonization process. The harmonization committee comprised of methodologists, health professionals and language professionals. Each word in the items of the questionnaire of the back translations was reviewed. Close attention was paid to the correspondence of each back translated item compared to the original version to assess whether these words reflected the same concept or ideas in both the original and adapted versions of the DMOQ. The instrument was adjusted accordingly after a consensus was reached. The harmonized DMOQ Malay version (M-H) was then produced after adjustments were made from discussion among the researchers (Appendix 3). This carefully planned process is outlined in the flow chart of the study process in the coming section of this chapter.

3.7.2 Phase 2: Face validation

A total of 20 T2DM patients from the NCD unit of KKSB were recruited for the process of face validation from the 1st until the 5th of June 2015. These patients were

given the self-administered DMOQ M-H version. After the patients completed the questionnaire, they were asked to comment on their understanding of the purpose, content, wording, instructions and general structure of the DMOQ M-H version. These comments were written on a paper attached to the questionnaire.

3.7.3 Phase 3: Field testing for psychometric analysis

Phase 3 of the study process involved field testing of the face validated DMOQ M-H version on the target population. Patients who fulfilled the inclusion and exclusion criteria were recruited into the study from the NCD unit of KKSB. Patients who participated for the face validation were not re-selected for the field testing.

3.8 Data collection

Data was collected from September 2015 to October 2015.The same researcher was assigned for the data collection throughout the data collection period.

3.8.1 Data collection procedure

1. T2DM patients who attended the NCD clinic on the day of the data collection were approached by the researcher in the waiting area. They were given the patient information sheet about the study in the Malay language (Appendix 3).

2. Patients were then screened via face to face interview to see whether they fulfilled both the inclusion and the exclusion criteria. Medical records were also checked for secondary data for confirmation of the inclusion and exclusion criteria. If the patients were deemed eligible, they were then invited into the study.

3. Patients who were invited into the study and willing to participate were then given the consent forms (Appendix 4) to sign and subsequently assigned a unique identification number. All the participants knew that they were free to withdraw from the study at any time without any penalties. Full confidentiality and anonymity was maintained.

4. Once the informed consent was signed, data for the demographic section of the questionnaire was collected via face-to-face interview. The participant was then given the self-administered DMOQ M-H version. They were informed that it would take about 10 to 15 minutes to complete the questionnaire. Clear instructions were given on how to fill up the questionnaires. They were asked to circle the options that suited them the most as well as to fill in subjective questions in the space given. The participants were informed that they could ask for clarification from the researcher at any time should any queries arise. The participants were reminded to answer the questionnaires themselves rather than getting their family members to complete it.

5. The participants were given a pen and a clipboard and offered a table and chair for them to complete the questionnaire in the nurses' anthropometry room. However, most of the participants decided to stay seated in their seats at the NCD waiting area. The participants were informed that they could fill in the questionnaire at their convenience while waiting for their turn to either see the staff nurse, doctor or even while waiting for their medications.

6. Once the participants have completed the questionnaire, the questionnaire was handed to the researcher. The questionnaire was then checked for completeness before the participant left the clinic. If any of the questions were not complete, the participant was kindly requested to fill in the sections before they left the clinic.

7. The participants were also given a date for them to return to the clinic in two weeks' time to complete the same questionnaire.

8. At the two weeks follow up, it was arranged for the participants to come directly to the NCD unit without having to go through the process of registering at the front desk counter. The participants were given the same questionnaire to complete at the NCD waiting area/nurse's work station.

This study employed the above methods in order to allow participants to complete the questionnaires at their convenience without being given a specific time deadline. This process ensured that the response provided reflected their true understanding of the questions without any pressure from their relatives. Therefore, the response bias due to time constraint, responses from relatives rather than the participants and presence of researcher were minimised.

3.8.2 Methods of data collection

3.8.2.1 Face-to-face interview method

This method of collecting data involves the primary researcher asking questions to the participants in face-to-face interview. This method was used to collect data for the demographic section of the questionnaire. The questions were predetermined and the primary researcher asked the questions in the form and order prescribed. The variables taken were age, gender, ethnicity, family history of T2DM, number of children without T2DM, personal status and highest formal education.

3.8.2.2 Retrieval of data from medical record

Data from the medical records of the patient namely the Diabetes record book from KKSB were obtained for the purpose of confirming personal information about the patient. Variables retrieved from the medical records included information on the length of duration having T2DM and the current treatment for the patient's T2DM. Retrieval of other data from the medical record was also important as some of the information were needed to ascertain whether the patient had any medical disorders or conditions that fulfilled the exclusion criteria. This included looking at the patient's prior medical history for any mental health illnesses and also the latest recorded medications.

3.8.2.3 Self-administered questionnaire

The self-administered DMOQ M-H version was given to participants who were eligible to participate in the study and has consented to do so.

3.8.3 Data handling

The data was entered and coded into a personal computer using SPSS version 21. The Likert Scale responses for the negatively phrased questions were reversed during the data entry.

3.9 Study variables

The operational definitions in this study are summarized in the table below:

Table 3.2: Operational definitions of the study

Variables	Description
Duration of having T2DM	As stated by the patient and/or verified from the medical record. Duration of having T2DM (in years).
Treatment of T2DM	As stated by the patient and/or verified from the medical record. Treatment of T2DM is categorized into 4 groups: Treatment with diet alone Treatment with diet and medications Treatment with diet and insulin Treatment with diet, medications and insulin
Family history of T2DM	As stated by the patient. Family history is categorized into 3 groups: Family history of siblings with T2DM Family history of parents with T2DM Family history of both siblings and parents
Number of children without T2DM	As stated by the patient.
Gender	As stated by the patient. Gender is categorized into 2 groups: Male Female
Age	Actual age (in years) obtained by subtracting interview date (year) from the patients' date of birth (year).
Ethnicity	As stated by the patient. Ethnicity is categorized into 4 groups: Malay Chinese Indian Bumiputera Sabah and Sarawak Other ethnicities
Personal status	As stated by the patient. Personal status is categorized into 4 groups: Married Widowed Divorced/Separated

	Single
Highest formal education	As stated by the patient. The highest level of formal education of the participant according to the Malaysian education system. Highest formal education is categorized into 4 groups: No formal education Primary school education = standard 1-6 Secondary school education = Form 1-6 Tertiary education = College / university

3.10 Statistical analysis

Data entry and statistical analysis was performed using IBM SPSS Statistics Version 21 (60). The questionnaire items were coded according to the concepts of the conceptual framework and this is provided in Appendix 5.

3.10.1 Descriptive statistics

Descriptive statistics were used to depict the demographic data of the participants of this study. The distribution of responses for categorical variables was presented in the form of frequency and percentages. Responses for numerical variables were presented n the form of mean and standard deviation.

3.10.2 Construct validity

Exploratory factor analyses (EFA) was performed to examine the construct validity (25) of the DMOQ M-H version i.e. the degree to which the items on the questionnaire relate to other variables in a manner consistent with the Health Belief

Model. The 5-Step Exploratory Factor Analysis Protocol (49) as shown in Figure 4.1 was used as a guide in performing the EFA in this study. EFA was used to define the constructs based on the theoretical framework thus indicating the direction of the measure (51, 52). Out of the 31 items, only 29 items were included in the EFA. Two items were excluded because they were questions with subjective responses.

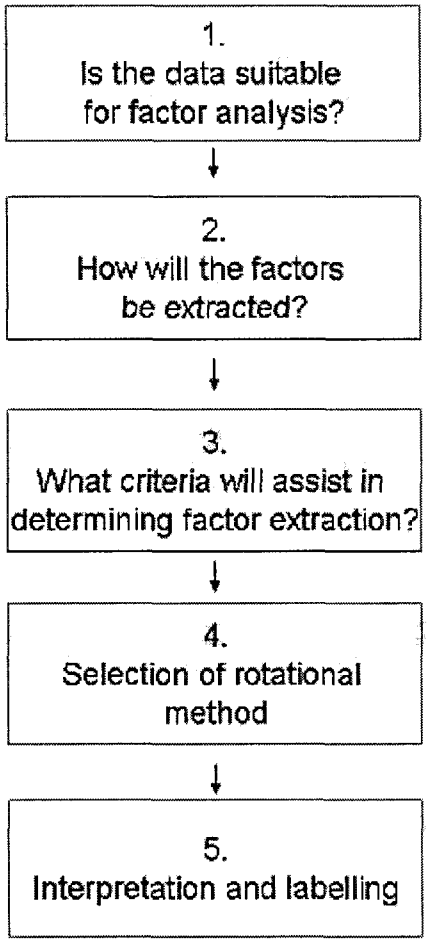


Figure 3.1: The 5-Step Exploratory Factor Analysis Protocol

3.10.2.1 Correlation matrix

Prior to the EFA, primary analysis was conducted to examine whether the variables correlated fairly. A correlation matrix was produced from the data to display the

strength of the relationship between individual variables. Correlation values of more 0.3 were considered acceptable (61).

3.10.2.2 Kaiser-Meyer-Olkin Measure of Sampling Adequacy and Bartlett's test of Sphericity

The Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and the Bartlett's Test of Sphericity (49) were performed to assess the suitability of the data for factor analysis. The KMO index was reported in a range of 0 to 1, with values of 0.50 considered suitable for proceeding to factor analysis (61). A significant Bartlett's Test of Sphericity with a p-value of less than 0.05 was considered suitable for factor analysis (61).

3.10.2.3 Communalities

Communalities were assessed to indicate the amount of variance in each variable that was accounted for by all components or factors (62).

3.10.2.4 Kaiser's criterion

The Kaiser criterion was used to determine which factors to retain based on an eigenvalue. If the eigenvalue of the factors was ≥1, then these factors considered suitable to be retained for further analysis (52).

3.10.2.5 Scree plot

A Scree plot was used to depict in graph form the descending variances that were accounted for the factors extracted. The cut-off point for selecting the number of factors to be retained should be at the inflexion of the curve, also known as the elbow of the curve. Any factors that lie before the point can be retained (52).

3.10.2.6 Component matrix

The Principal Component Analysis (PCA) was used for the factor extraction in this study. This is the preferred method (50) compared to the Principal Axis Factoring (PAF) (52).

3.10.2.7 Rotated component matrix

Varimax, which is the most commonly used orthogonal rotation was used in this study to rotate the factors in order to maximise the loading on each of the variable as well as minimising the loading on other factors (52).

3.10.2.8 Interpretation and labelling

This step of the process involved the researcher examining which variables were attributable to a factor, and giving that factor a name or theme. It is imperative that these labels or constructs reflect the theoretical and conceptual intent (49).

3.10.3 Reliability analysis

Reliability analysis was conducted in this study to measure the degree of consistency of the DMOQ M-H version.

3.10.3.1 Internal consistency reliability

The internal consistency reliability was determined in this study by calculating the Cronbach alpha. The total score of all the items was calculated to give an estimation of the consistency of the whole questionnaire (47). Cronbach's alpha was computed for each of the subscale in the DMOQ as the questionnaire contained more than one subscale (51). An acceptable Cronbach alpha value was considered to be between 0.70 to 0.90 (51).

3.10.3.2 Test-retest reliability

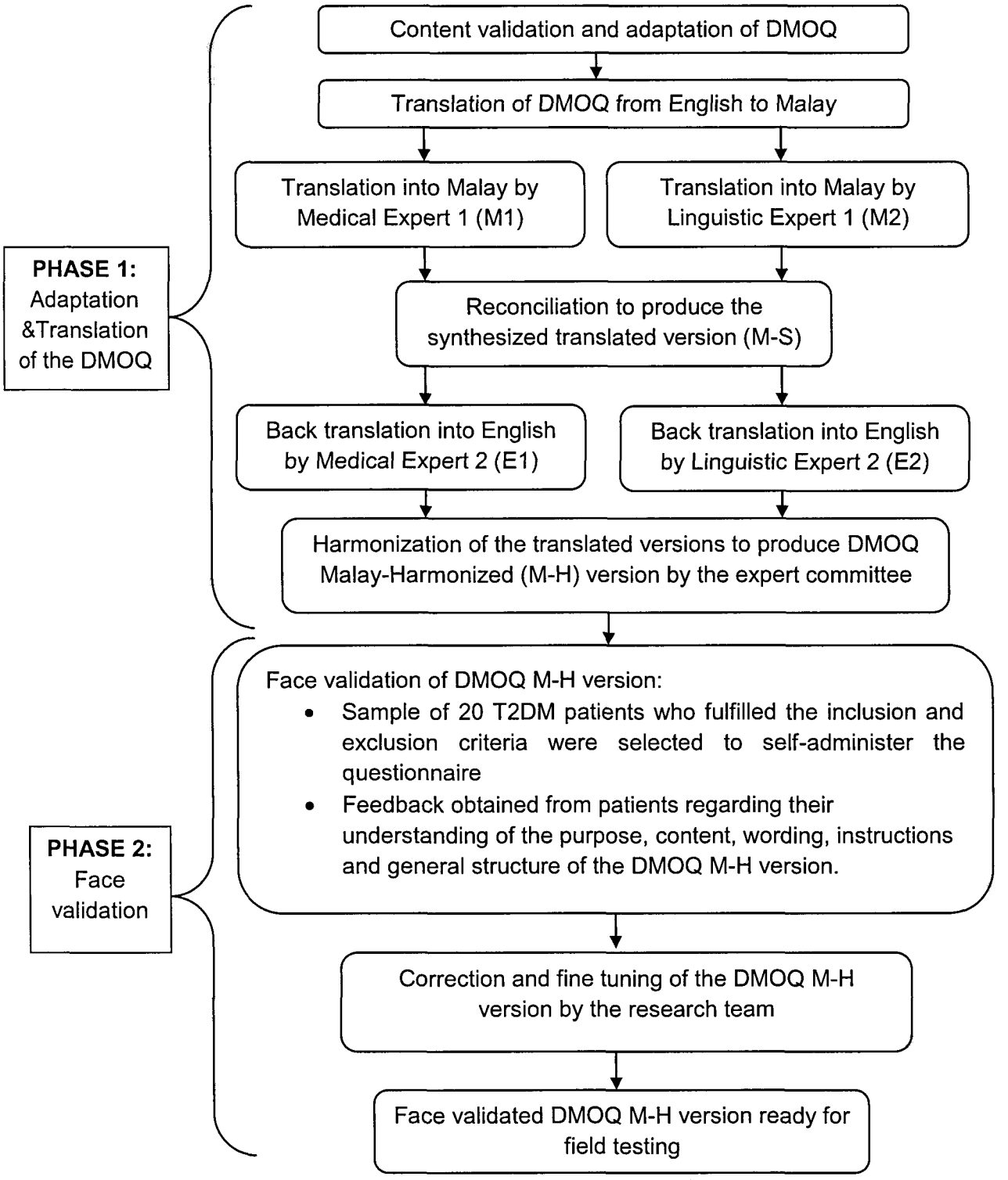
The test-retest reliability was assessed by calculating the interclass correlation. A high correlation between the scores at the two points in time indicated that the questionnaire under study was stable over time (51).

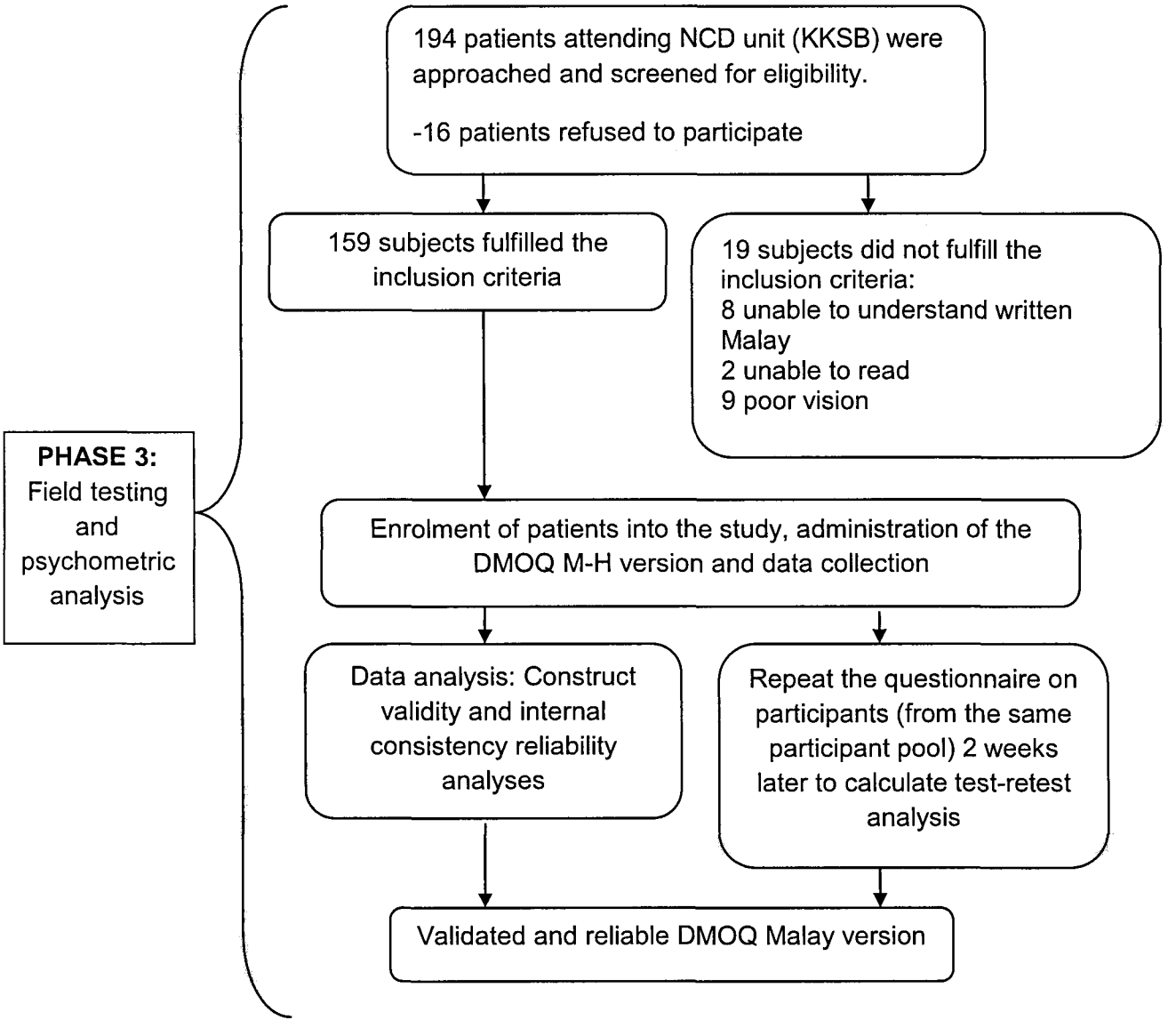
3.11 Ethical approval

Ethical approval for this study was obtained from the National Medical Research Register (NMRR-14-1861-22954(IIR)) Medical Ethics and Research Committee (MREC) (Appendix 6) and the University Research Ethics Committee (Appendix 7).The Family Medicine Specialist (FMS) at KKSB was approached for permission to collect data at the NCD unit following the approval from the NMRR ethics committee.

3.12 Flow chart of the conduct of the study

This flow chart shows the outline of this study in three phases as follows:




PHASE 3:
Field testing and psychometric analysis
194 patients attending NCD unit (KKSB) were approached and screened for eligibility.
-16 patients refused to participate
159 subjects fulfilled the inclusion criteria
19 subjects did not fulfill the inclusion criteria:
8 unable to understand written Malay
2 unable to read
9 poor vision
Enrolment of patients into the study, administration of the DMOQ M-H version and data collection
Data analysis: Construct validity and internal consistency reliability analyses
Repeat the questionnaire on participants (from the same participant pool) 2 weeks later to calculate test-retest analysis
Validated and reliable DMOQ Malay version

CHAPTER 4: RESULTS

4.1 Phase 1: Content validity

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 nucleus family members i.e. their offspring and spouse compared to their siblings. Thus, the expert review committee at this stage agreed on removing items that examined risk perception on siblings. Three items from the original DMOQ were therefore removed from the questionnaire. These items were:

1) How likely do you think it is that any of your brothers and sisters will get Diabetes sometime in their life?
2) Do you worry that your brothers and sisters might get Diabetes sometime in their life?
3) Have you talked to any of your brothers and sisters about the possibility of the getting Diabetes?

A note at the end of Question 1 was also removed as one of our inclusion criteria was that patients recruited into this study must have at least one offspring without Diabetes Mellitus. All the remaining 31 items were considered appropriate and relevant to the study and were retained.

4.2 Phase 2: Face validation

Feedback from the patients was as follows:

1) 100% of the participants found the purpose and content of the questionnaire easy to understand.

2) 95% of the participants found the instruction for the first question to be confusing and too long. The original DMOQ had an example given to instruct the patients on how to answer the question regarding their knowledge of risk factors of Diabetes Mellitus. However, the example given in the questionnaire was related to means of travelling to work. Thus, our patients found it confusing and felt that it does not need to be inserted into the questionnaire, as they found the question on knowledge of risk factors to be quite clear without requiring the example.

3) 90% of the participants found that the instructions on most of the questions to be too long and suggested to be simpler. This included the instructions in Section 2, 4, 6 and 7.

4) 25.1% of the participants found that the Likert scales in the different sections were confusing as they varied from each other in even and odd numbered scales, ranging between 4 to 7-point Likert scale.
5) 100% of the participants found the general structure of the questionnaire acceptable.

A review of the feedback from the patients against the original version of the instrument was conducted by the research team to ensure cultural relevance. Findings of the face validation process were incorporated to improve the performance

of the translated Malay version of the questionnaire. The following changes were made to the DMOQ M-H version based on the feedback from the patients through this face validation process:

1) The instructions on most of the questions were made simpler. The example given in the questionnaire which was related to means of travelling to work was also removed.

2) The items in Section 2, 4 and 7 were changed from a 4-point, 6-point and 7-point Likert scale rating respectively to a standardized 5-point Likert scale.

The revised DMOQ M-H version underwent a second face validation which included another 20 T2DM patients from the NCD unit of KKSB to face validate the changes made to the DMOQ-MH version. The feedback obtained on the content, wording, instructions and general structure of the DMOQ M-H version showed that the questionnaire was satisfactory and no further amendments or alterations were made. The revised DMOQ-MH version which has been face validated was ready to be tested for its psychometric properties.

4.3 Phase 3: Field testing for psychometric analysis

4.3.1 Recruitment rate

A total of 194 T2DM patients from the NCD Unit at KKSB were approached and invited to enter the study. Out of those who were approached, 16 (10%) patients refused to participate, citing reasons such as 'I did not bring my spectacles', 'I am in a hurry' and 'I have previously filled in a questionnaire before this, so I am not willing to fill this one'. Another 19 (11.9%) patients were not eligible to enter the study as they did not fulfil the inclusion and/or the exclusion criteria. Therefore, the recruitment rate

for this study was 85.4% giving a total number of 159 eligible T2DM patients who completed the questionnaire. Overall, the time taken to complete the self-administered questionnaire was approximately 10 to 15 minutes.

4.3.2 Descriptive statistics

The demographic characteristics of the participants are shown in Table 5.1. There were 77 males and 82 females whom participated in this study. The age of the patients ranged between 35 to 78 years old with a mean of 54.87 years (SD 8.22). Majority of the participants were Malays (86.2%). The duration of T2DM of the participants ranged between <1 year to 40 years. The mean duration of T2DM was 7.05 years (SD 6.37). A majority of the patients were treated with diet and medications (68.6%). In terms of family history, 35.2% of the participants reported that they have parents with T2DM, 22% reported that they have siblings with T2DM and the remaining 17.6% had a history of both parents and siblings with T2DM.

The number of offspring without T2DM ranged between 1 and 4, with a mean of 4 (SD 1.47). In terms of personal status, 87.4% of the participants were married, 11.9% were widowed and 0.6% were divorced/separated. Among the participants, 54.7% of them completed secondary school, while 29.6% completed tertiary education level and the remaining 13.2% and 2.5% completed primary school education and received no formal education, respectively.

Table 4.1: Demographics characteristics of participants

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	
Number of offspring without T2DM				4 (1.47)
Personal status	Married	139	87.4	
	Widowed	19	11.9	
	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 4.2 shows knowledge of the participants regarding Diabetes risk factors. Majority of the participants had the knowledge that having a parent with T2DM, being overweight and taking little or no exercise, were risk factors for developing T2DM.

Table 4.2: Knowledge of Diabetes Mellitus risk factors

No	Diabetes risk factors	n (%)
1	Having a parent with type 2 Diabetes	101 (63.5)
2	Being overweight	91 (57.2)
3	Taking little or no exercise	80 (50.3)
4	Being over 40 years of age	56 (35.2)
5	Having a brother or sister with type 2 Diabetes	40 (25.2)
6	High salt intake	18 (11.3)
7	I don't know	15 (9.4)

Table 4.3 shows the participants' knowledge of risk reduction of developing Diabetes Mellitus. Less than half of the participants (33.3%) were aware that healthy lifestyle including diet and exercise were important to reduce the risk of developing Diabetes.

Table 4.3: Knowledge of risk reduction of developing T2DM

Knowledge of risk reduction of developing T2DM	n (%)
Healthy diet and exercise	53 (33.3)
Healthy diet	35 (21.4)
Healthy lifestyle	27 (17.0)
Exercise	19 (11.9)
Avoid sweet food	18 (11.3)
None	2 (1.3)
Avoid sweet food, carbonated beverages,too much rice	1 (0.6)
Compliance to meds and exercise	1 (0.6)
Get advice from their doctors	1 (0.6)
Reduce food intake	1 (0.6)
To get information	1 (0.6)

Table 4.4 shows the participants' perception of susceptibility of their offspring to develop T2DM. Majority of the participants (64.8%) perceived their offspring to be quite likely to develop T2DM.

Table 4.4: Perception of susceptibility of offspring developing T2DM

No	Item	n (%)					Median (IQR)
		Not at all likely	Not very likely	Neutral	Quite likely	Very likely	
1	How likely do you think that any of your children will get Diabetes sometime in their life?	10 (6.3)	29 (18.2)	0	103 (64.8)	17 (10.7)	3 (0)
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?	6 (3.8)	24 (15.1)	0	106 (66.7)	23 (14.5)	3 (0)
3	Do you worry that your children might get Diabetes sometime in their life?	12 (7.5)	13 (8.2)	0	69 (43.4)	65 (40.9)	3 (1)

Table 4.5 and 5.6 show the responses of the participants to cues to action. Majority of the participants (67.9%) have spoken to all of their children about their risk of developing T2DM, while 15.1% have spoken to some of their children. Majority of the participants (66.7%) were willing to accept training if it was offered to them to help them speak to their children about their risk of developing T2DM and ways to reduce this risk.

Table 4.5: Responses to cues to action

No	Cues to action	n (%)		
		None	Some	All
1	Have you talked to any of your children about the possibility of them getting Diabetes?	27 (17)	24 (15.1)	108 (67.9)

Table 4.6: Responses to cues to action

No	Item	n (%)					Median (IQR)
		Strongly disagree	Disagree	Neutral	Agree	Strongly agree	
1	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 this.	21 (13.2)	32 (20.1)	0	83 (52.2)	23 (14.5)	3 (1)

Table 4.7 shows the participants' motivation to cues to action. Participants responded that adopting healthy habits and exercise (10.7%) and to increase knowledge about T2DM (10.7%) were their motivation to cues to action.

Table 4.7: Motivation to cues to action

Response regarding motivation to cues to action	n (%)
Adopt healthy eating habits and exercise	17 (10.7)
To increase knowledge about DM	17 (10.7)
Sharing of my experience	14 (8.8)
None	12 (7.5)
Talking about healthy diet	11 (6.9)
Pamphlet about health	11 (6.9)
To talk about complications of DM	10 (6.3)
Advise to reduce sweet food	10 (6.3)
Advice from specialist and doctors	8 (5.0)
Knowing about their fhx of DM	5 (3.1)
Videos about health	5 (3.1)
Courses for patients and lay persons	4 (2.5)
During mealtimes	2 (1.3)
Media	2 (1.3)

Response regarding motivation to cues to action	n (%)
To tell them about risk and prevention	2 (1.3)
Advise my children for yearly medical check up, healthy diet and exercise	1 (0.6)
Articles in the newspaper regarding DM	1 (0.6)
Discussion in the car or at mealtimes	1 (0.6)
Exercise	1 (0.6)
Fact sheet	1 (0.6)
Facts and tests	1 (0.6)
Food graphs	1 (0.6)
From own experience and pictures on websites	1 (0.6)
Genetic and unhealthy diet	1 (0.6)
If condition is worsening	1 (0.6)
If my children asked me	1 (0.6)
Informing her chidlren of their risk of DM due to her having it	1 (0.6)
Information in internet	1 (0.6)
Knowledge and own experience	1 (0.6)
Learn from the right sources	1 (0.6)
Learning from friends	1 (0.6)
Ongoing advice	1 (0.6)
posters and pamphlets	1 (0.6)
Reading materials	1 (0.6)
Refer to other serious cases	1 (0.6)
Television advertisements about complications of DM	1 (0.6)
Television and internet	1 (0.6)
To get information from own reading	1 (0.6)
To get knowledge and experience and skill	1 (0.6)
To get knowledge from the relevant authorities	1 (0.6)
To get my family to exercise together	1 (0.6)
To make myself as an example so that they become more careful with their diet	1 (0.6)

Table 4.8 shows the participants' perceived benefits of speaking to their offspring about risk of Diabetes Mellitus. Majority of the participants either agreed or strongly agreed on the perceived benefits of speaking to their offspring about their risk of developing T2DM and risk reduction methods.

Table 4.8: Perceived benefits of speaking to offspring about Diabetes risk

No	Item	n (%)					Median (IQR)
		Strongly disagree	Disagree	Neutral	Agree	Strongly agree	
1	Make my relatives more aware of the importance of diet and exercise.	2 (1.3)	4 (2.5)	0	81 (50.9)	72 (45.3)	3 (1)
2	Encourage them to make some changes to their lifestyle.	2 (1.3)	5 (3.1)	0	94 (59.1)	58 (36.5)	3 (1)
3	Help prevent them developing Diabetes.	3 (1.9)	7 (4.4)	0	73 (45.9)	76 (47.8)	3 (1)

Table 4.9 shows the participants' perceived barriers of speaking to their offspring about risk of Diabetes Mellitus. Majority of the participants disagreed that they have barriers to speak to their offspring about risk of Diabetes Mellitus.

Table 4.9: Perceived barriers of speaking to offspring about Diabetes risk

No	Item	n (%)					Median (IQR)
		Strongly disagree	Disagree	Neutral	Agree	Strongly agree	
1	I do not have a healthy lifestyle myself.	13 (8.2)	85 (53.5)	0	56 (35.2)	5 (3.1)	2 (1)
2	I do not have much contact with my relatives.	52 (32.7)	89 (56)	0	15 (9.4)	3 (1.9)	2 (1)
3	My relatives are not open to advice from me.	37 (23.3)	85 (53.5)	0	32 (20.1)	5 (3.1)	2 (0)
4	They do not see Diabetes as a serious illness.	31 (19.5)	85 (53.5)	0	34 (21.4)	9 (5.7)	2 (1)
5	They do not believe they are at risk of getting Diabetes.	23 (14.5)	86 (54.1)	0	45 (28.3)	5 (3.1)	2 (1)

Table 4.10 shows the participants' perception of severity of diseases compared to Diabetes Mellitus. Majority of the participants perceived that cancer and AIDS as very serious compared to only 49.1% of the participants perceived that T2DM as very serious.

Table 4.10: Perception of severity of diseases compared to Diabetes Mellitus

No	Item	n (%)					Median (IQR)
		Not serious	Mildly serious	Quite serious	Serious	Very serious	
1	Cancer	4 (2.5)	0	3 (1.9)	42 (26.4)	110 (69.2)	5 (1)
2	Flu	47 (29.6)	60 (37.7)	36 (22.6)	14 (8.8)	2 (1.3)	2 (2)
3	Diabetes Mellitus	4 (2.5)	4 (2.5)	8 (5)	65 (40.9)	78 (49.1)	4 (1)
4	AIDS	4 (2.5)	2 (1.3)	2 (1.3)	21 (13.2)	130 (81.8)	5 (0)
5	Arthritis	9 (5.7)	26 (16.4)	44 (27.7)	63 (39.6)	17 (10.7)	4 (1)

Table 4.11 shows the participants' value placed on health as a possible motivator of cues to action. Majority of the participants either agreed or strongly agreed that 'If you do not have health, you do not have anything'.

Table 4.11: Value placed on health as a possible motivator to cues to action

No	Item	n (%)					Median (IQR)
		Strongly disagree	Disagree	Neutral	Agree	Strongly agree	
1	There is nothing more important than good health.	43 (27)	52 (32.7)	0	25 (15.7)	39 (24.5)	4 (1)
2	Good health is only a minor importance in a happy life.	10 (6.3)	30 (18.9)	0	67 (42.1)	52 (32.7)	2 (2)
3	If you don't have your health, you don't have anything.	10 (6.3)	30 (18.9)	0	67 (42.1)	52 (32.7)	3 (2)

4	There are many things I care about more than my health.	71 (44.7)	63 (39.6)	0	16 (10.1)	9 (5.7)	2 (1)

4.3 Construct validity

4.3.1 Correlation matrix

Table 4.12 shows the correlation between the 29 items which were included in the EFA. All the values were above 0.3, and this is considered acceptable.

Table 4.12: Inter-item correlation matrix

	K1	K2	K3	K4	K5	K6	K7	SUSCEP 1	SUSCEP 2	SUSCEP 3	CUE1	CUE2
K1	1.000	0364	0.418	0.562	0.339	0.698	0.426	0.554	0.523	0.438	0.359	0.309
K2		1.000	0.588	0.412	0.512	0.391	0.373	0.667	0.538	0.358	0.560	0.419
K3			1.000	0.376	0.694	0.367	0.515	0.730	0.504	0.501	0.382	0.430
K4				1.000	0.511	0.470	0.325	0.344	0.419	0.414	0.476	0.352
K5					1.000	0.570	0.438	0.379	0.670	0.332	0.430	0.389
K6						1.000	0.487	0.340	0.350	0.316	0.506	0.347
K7							1.000	0.452	0.720	0.414	0.038	0.369
SUSCEP 1								1.000	0.673	0.424	0.430	0.459
SUSCEP 2									1.000	0.597	0.403	0.341
SUSCEP 3										1.000	0.401	0.497
CUE1											1.000	0.549
CUE2												1.000

Table 4.12: Inter-item correlation matrix (continued)

	BEN1	BEN2	BEN3	BAR1	BAR2	BAR3	BAR4	BAR5	SEV1	SEV2	SEV3	SEV4	SEV5
K1	0.507	0.541	0.559	0.513	0.345	0.356	0.410	0.431	0.423	0.432	0.493	0.464	0.417
K2	0.555	0.542	0.614	0.570	0.351	0.336	0.316	0.448	0.477	0.493	0.565	0.512	0.428
K3	0.574	0.549	0.526	0.619	0.315	0.312	0.510	0.445	0.485	0.493	0.415	0.510	0.419
K4	0.567	0.514	0.570	0.581	0.348	0.326	0.555	0.433	0.436	0.446	0.527	0.427	0.428
K5	0.577	0.528	0.543	0.552	0.360	0.366	0.527	0.432	0.460	0.455	0.469	0.492	0.517
K6	0.574	0.581	0.628	0.623	0.317	0.470	0.532	0.439	0.440	0.477	0.473	0.415	0.547
K7	0.572	0.595	0.595	0.532	0.302	0.315	0.609	0.421	0.484	0.440	0.565	0.471	0.420
SUSCEP 1	0.792	0.693	0.723	0.602	0.316	0.424	0.520	0.469	0.425	0.494	0.543	0.463	0.411
SUSCEP 2	0.645	0.628	0.716	0.546	0.363	0.443	0.533	0.421	0.397	0.457	0.682	0.414	0.511
SUSCEP 3	0.735	0.796	0.738	0.661	0.423	0.476	0.589	0.457	0.507	0.407	0.615	0.430	0.508
CUE1	0.641	0.597	0.561	0.345	0.556	0.414	0.553	0.432	0.469	0.477	0.460	0.505	0.455
CUE2	0.696	0.762	0.729	0.418	0.427	0.406	0.507	0.433	0.480	0.425	0.482	0.427	0.509
BEN1	1.000	0.618	0.589	0.421	0.415	0.450	0.591	0.543	0.615	0.461	0.624	0.585	0.426
BEN2		1.000	0.697	0.474	0.354	0.421	0.574	0.428	0.577	0.496	0.697	0.597	0.498
BEN3			1.000	0.414	0.394	0.490	0.573	0.409	0.604	0.428	0.607	0.577	0.409
BAR1				1.000	0.526	0.381	0.587	0.667	0.490	0.492	0.628	0.480	0.424
BAR2					1.000	0.583	0.344	0.379	0.430	0.518	0.456	0.426	0.485
BAR3						1.000	0.443	0.505	0.411	0.445	0.481	0.406	0.437
BAR4							1.000	0.724	0.416	0.482	0.440	0.443	0.415
BAR5								1.000	0.401	0.423	0.459	0.450	0.422
SEV1									1.000	0.453	0.510	0.793	0.372
SEV2										1.000	0.668	0.447	0.416
SEV3											1.000	0.494	0.412
SEV4												1.000	0.473
SEV5													1.000

Table 4.12: Inter-item correlation matrix (continued)

	HVS1	HVS2	HVS3	HVS4
K1	0.407	0.425	0.471	0.439
K2	0.504	0.460	0.470	0.463
K3	0.429	0.449	0.541	0.451
K4	0.466	0.547	0.429	0.528
K5	0.400	0.457	0.570	0.432
K6	0.410	0.427	0.474	0.439
K7	0.575	0.470	0.552	0.640
SUSCEP1	0.638	0.560	0.577	0.510
SUSCEP2	0.614	0.441	0.434	0.411
SUSCEP3	0.693	0.409	0.496	0.455
CUE1	0.421	0.469	0.410	0.575
CUE2	0.491	0.500	0.528	0.486
BEN1	0.427	0.426	0.462	0.438
BEN2	0.381	0.405	0.562	0.430
BEN3	0.352	0.457	0.575	0.493
BAR1	0.556	0.408	0.532	0.636
BAR2	0.423	0.414	0.542	0.617
BAR3	0.502	0.438	0.486	0.669
BAR4	0.558	0.514	0.412	0.395
BAR5	0.475	0.415	0.476	0.684
SEV1	0.678	0.553	0.596	0.438
SEV2	0.402	0.413	0.442	0.405
SEV3	0.686	0.565	0.452	0.414
SEV4	0.628	0.545	0.516	0.429
SEV5	0.678	0.469	0.484	0.497
HVS1	1.000	0.434	0.599	0.666
HVS2		1.000	0.491	0.492
HVS3			1.000	0.405
HVS4				1.000

4.3.2 KMO Measure of Sampling Adequacy and Bartlett's test of Sphericity

Table 5.13 shows that the value of KMO for the DMOQ Malay version was 0.659 which is an acceptable value, with a significant p-value of <0.001 for the Bartlett's test of sphericity. The KMO and the Bartlett's test of sphericity values indicate that the data of this data was suitable to proceed for factor analysis.

Table 4.13: Values of the KMO Sampling Adequacy and Bartlett's test of sphericity

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.659
Bartlett's Test of Sphericity	Approx. Chi-Square	1428.776
	df	406
	Sig.	<0.001

4.3.3 Communalities

Table 5.14: Communalities

	Initial	Extraction
K1	1.000	0.651
K2	1.000	0.515
K3	1.000	0.648
K4	1.000	0.599
K5	1.000	0.655
K6	1.000	0.588
K7	1.000	0.689
SUSCEP1	1.000	0.581
SUSCEP2	1.000	0.561
SUSCEP3	1.000	0.682
CUE1	1.000	0.568
CUE2	1.000	0.669
BEN1	1.000	0.689
BEN2	1.000	0.761
BEN3	1.000	0.754
BAR1	1.000	0.554
BAR2	1.000	0.647
BAR3	1.000	0.686
BAR4	1.000	0.725
BAR5	1.000	0.657
SEV1	1.000	0.842
SEV2	1.000	0.781
SEV3	1.000	0.703
SEV4	1.000	0.827
SEV5	1.000	0.707
HVS1	1.000	0.583
HVS2	1.000	0.703
HVS3	1.000	0.655
HVS4	1.000	0.545

Table 4.14 shows the communality of the items of the questionnaire. The highest value was 0.842 and the lowest value was 0.515. This indicates that 84.2% of its variability was explained by the factor SEV1.

4.3.4 Kaiser's criterion

Table 4.15 shows the initial eigenvalues for each factor of the DMOQ Malay version. On the first run PCA, the total variance of the DMOQ Malay version was 66.29%. When Kaiser's criterion was applied to the DMOQ Malay version, ten factors had eigenvalues exceeding 1.0, which means that these factors could be retained for analysis.

Table 4.15: Initial Eigenvalues for each factor of the DMOQ M-H version

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.053	13.977	13.977	4.053	13.977	13.977
2	3.293	11.357	25.334	3.293	11.357	25.334
3	2.357	8.128	33.461	2.357	8.128	33.461
4	2.021	6.971	40.432	2.021	6.971	40.432
5	1.512	5.215	45.648	1.512	5.215	45.648
6	1.361	4.692	50.339	1.361	4.692	50.339
7	1.283	4.423	54.762	1.283	4.423	54.762
8	1.192	4.111	58.873	1.192	4.111	58.873
9	1.087	3.750	62.623	1.087	3.750	62.623
10	1.063	3.667	66.290	1.063	3.667	66.290
11	0.959	3.308	69.598			
12	0.909	3.133	72.731			
13	0.856	2.951	75.682			
14	0.835	2.881	78.563			
15	0.712	2.456	81.019			
16	0.655	2.259	83.278			
17	0.624	2.151	85.429			
18	0.598	2.062	87.490			
19	0.490	1.689	89.179			
20	0.476	1.641	90.820			
21	0.436	1.502	92.322			
22	0.402	1.387	93.710			
23	0.380	1.312	95.021			
24	0.314	1.084	96.106			
25	0.299	1.030	97.135			
26	0.258	0.888	98.023			
27	0.240	0.829	98.852			
28	0.184	0.633	99.486			
29	0.149	0.514	100.000			

4.3.5 Scree Plot

Figure 4.1 shows the Scree Plot that was generated from the analysis. The elbow of the Scree plot occurs at 5 as the line starts to straighten at factor 5. This means that four of those factors explained most of the variability and therefore could be retained.

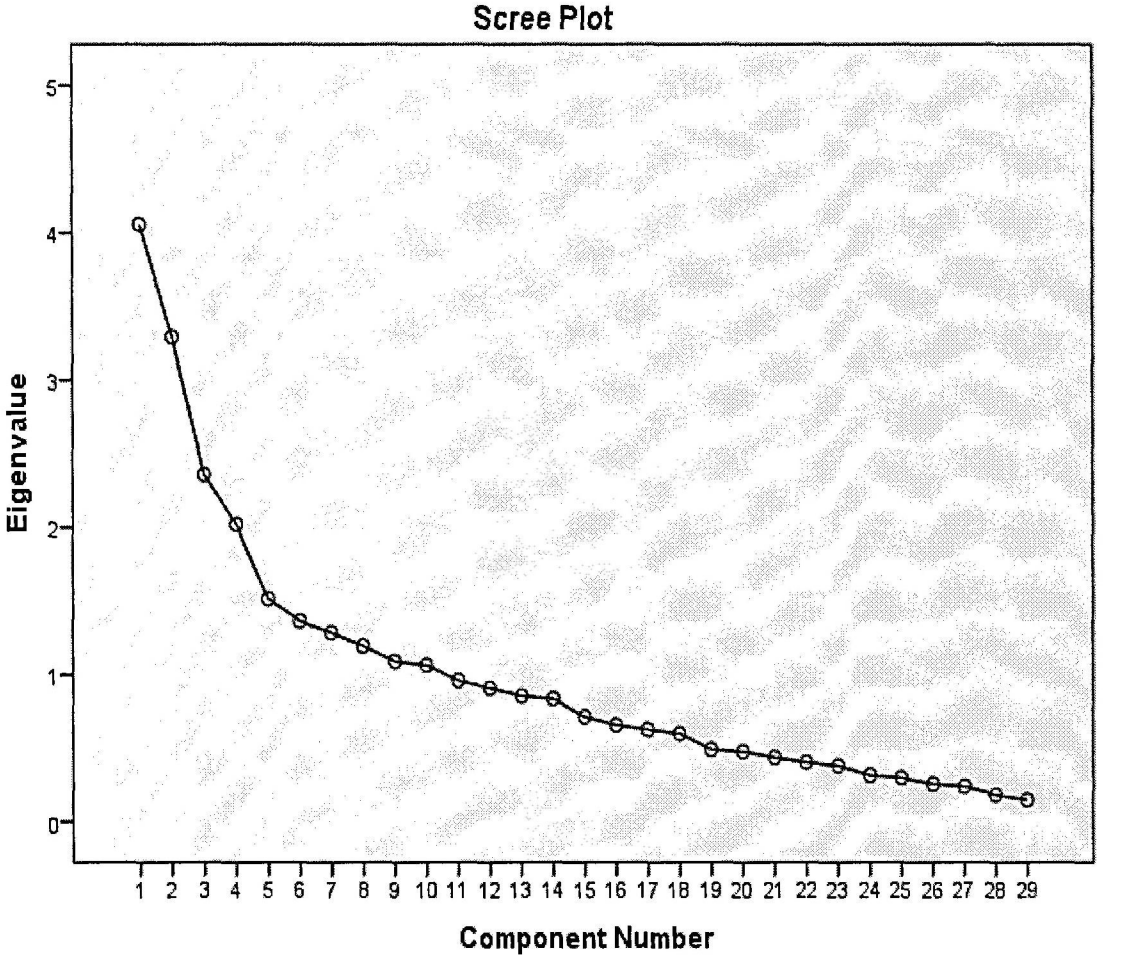


Figure 4.1: Scree plot for the DMOQ M-H version

4.3.6 Component matrix

The Kaiser criterion and the Scree test suggested retaining different numbers of factors 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 was reanalysed by fixing the number of factors at seven factors. Table 5.16 shows the component matrix extracted that present the factor loading for all items in the seven components prior to rotation.

Table 4.16: Component matrix showing factor loadings of items prior to rotation

	Component						
	1	2	3	4	5	6	7
K1						0.467	
K2			0.483				
K3						0.506	
K4			0.566				
K5			0.538				
K6					0.438		
K7			0.494			0.465	
SUSCEP1	0.444						
SUSCEP2	0.401						
SUSCEP3	0.513						
CUE1		0.431			0.403		
CUE2						0.564	
BEN1	0.643						
BEN2	0.672			0.402			
BEN3	0.658			0.413			
BAR1		0.541					
BAR2		0.585					
BAR3		0.695					
BAR4		0.694					
BAR5		0.706					
SEV1	0.556			0.466			
SEV2					0.566		
SEV3	0.604						
SEV4	0.500			0.445			
SEV5				0.530	0.400		
HVS1	0.639						
HVS2							
HVS3							
HVS4		0.488					0.427

4.3.7 Rotated component matrix

Table 4.17 shows the pattern of correlation matrix (factor loadings) after rotation. Correlation coefficients exceeding 0.4 was considered important, and those below 0.4 were suppressed.

Table 4.17: Factor structure after Varimax rotation

	Component						
	1	2	3	4	5	6	7
K1					0.663		
K2					0.412	0.462	
K3						0.724	
K4						0.598	
K5						0.474	
K6							0.493
K7					0.801		
SUSCEP1				0.664			
SUSCEP2				0.589			
SUSCEP3				0.592			
CUE1							
CUE2		0.470				0.420	
BEN1		0.759					
BEN2		0.831					
BEN3		0.787					
BAR1	0.559						
BAR2	0.685						
BAR3	0.775						
BAR4	0.758						
BAR5	0.773						
SEV1			0.848				
SEV2							0.678
SEV3			0.672				
SEV4			0.856				
SEV5			0.425				0.684
HVS1				0.551			
HVS2							
HVS3							
HVS4	0.536						

From this analysis, it was noted that the questions on perceived barriers (BAR1, BAR2, BAR3, BAR4 and BAR5) loaded onto the same factor as HVS4 which is the fourth question of the Health Value Scale. Questions on perceived benefits (BEN1, BEN2, BEN3) loaded onto the same factor as question 2 of the cues to action scale. All the questions on perceived severity loaded onto the same factor except SEV2 which loaded onto the same component as question 6 from the knowledge of risk factors. All three questions from the perceived susceptibility loaded onto the same factor together with HVS1 from the Health Value scale. K1 and K7 loaded onto the same factor while K2, K3, K4 and K5 loaded together onto the same factor.

As a result of this analysis, items CUE1, HVS2 and HVS3 were eliminated from the factor pattern matrix of the DMOQ M-H version as they did not meet the minimum requirement for factor loading (minimum value of 0.4). Therefore, these three items were eliminated from the questionnaire and further analysis. The remaining 26 items with factor loadings of >0.40 were retained.

Further PCA of the seven factor solution with 26 items accounted for 59.23% of the total variance. The factor loadings of the PCA and their factorial weights are shown in the following Table 5.18.

Table 4.18 Factor loadings of the seven factor solution

Coding	Items	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
	Perceived barrier	Loadings						
BAR1	I do not have a healthy lifestyle myself	0.559						
BAR2	I do not have much contact with my relatives	0.676						
BAR3	My relatives are not open to advice from me	0.780						
BAR4	They do not see Diabetes as a serious illness	0.773						
BAR5	They do not believe they are at risk of getting Diabetes	0.780						
HVS4	There are many things I care about more than my health	0.531						
	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.		0.440					
BEN1	Make my relatives more aware of the importance of diet and exercise		0.771					
BEN2	Encourage them to make changes to their lifestyle		0.851					
BEN3	Help prevent them developing Diabetes		0.816					
	Perceived severity			Loadings				
SEV1	Severity of cancer			0.897				
SEV3	Severity of Diabetes			0.635				
SEV4	Severity of AIDS			0.901				

Table 4.18 Factor loadings of the seven factor solution (continued)

Coding	Items	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
	Perceived susceptibility				Loadings			
SUSCEP1	How likely do you think it is that any of your children will get Diabetes sometime in their life?				0.681			
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?				0.578			
SUSCEP3	Do you worry that your children might get Diabetes sometime in their life?				0.637			
HVS1	There is nothing more important that good health				0.546			
						Loadings		
K1	Having a parent with type 2 Diabetes					0.726		
K7	I don't know					0.772		
	Knowledge of risk factors						Loadings	
K2	Being overweight						0.487	
K3	High salt intake						0.707	
K4	Taking little or no exercise						0.609	
K5	Being over 40 years of age						0.611	
								Loadings
K6	Having a brother or sister with type 2 Diabetes							0.415
SEV2	Severity of flu							0.797
SEV5	Severity of arthritis							0.714

4.3.8 Interpretation and labelling

The items and their factor loadings as depicted in the previous Table 4.18 shows that the 26 items were loaded onto seven factors. However, only five of the seven factors were interpreted and identified to be conceptually equivalent to the theoretical framework of the original DMOQ based on the concepts of the Health Belief Model.

The remaining two factors (Factor 5 and 7) were not identifiable in terms of the concepts from the Health Belief Model. Thus, items K1, K6, K7, SEV2 and SEV5 which loaded onto the two factors were eliminated from the DMOQ M-H version and further analysis as there were not identified to form or fit into a particular concept. The item HVS1 which loaded onto Factor 4 was also noted to not fit conceptually, and thus was removed as well. This leaves the DMOQ M-H version with five identifiable concepts including perceived barriers, perceived benefits, perceived severity, perceived susceptibility and knowledge of risk factors.

In summary, a total of nine items were removed from the questionnaire as a result of the EFA process. Three items (CUE1, HVS2, HVS3) were removed due to poor factor loading of < 0.4. Five items (K1, K6, K7, SEV2, and SEV5) were removed as there were loaded onto unidentifiable concepts and 1 item (HVS1) removed as it did not fit conceptually with the factor it loaded onto. Therefore, the five factor solution with 20 items were reanalysed in the final run of the PCA. Table 4.19 shows the factor loadings of the final PCA and their factorial weights which accounted for 56.33% of the total variance.

Table 4.19: 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	

Table 4.19: Factor loadings on the final five factor solution PCA

Coding	Items	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
	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

4.4 Reliability analysis

4.4.1 Internal consistency reliability

Cronbach's alpha was computed for the DMOQ M-H version after the process of construct validation was completed. The alpha values computed for each of the subscales and the total Cronbach alpha are shown in Table 5.20. The total Cronbach alpha of the revised DMOQ M-H version was 0.714. This indicates an acceptable internal consistency between the items within the DMOQ M-H version.

Table 5.20: Cronbach alpha for each of the subscale and the total Cronbach alpha of the DMOQ M-H version

Concept	Items	Cronbach alpha of each subscale	Total Cronbach alpha
Perceived barriers	BAR1 BAR2 BAR3 BAR4 BAR5 HVS4	0.776	0.712
Perceived benefits	BEN1 BEN2 BEN3 CUE2	0.666	
Perceived severity	SEV1 SEV3 SEV4	0.810	
Perceived susceptibility	SUSCEP1 SUSCEP2 SUSCEP3	0.612	
Knowledge of risk factors	K2 K3 K4 K5	0.592	

4.4.2 Test-retest reliability

Out of the 159 participants, 31 (19.4%) came back for the retest and completed answering the DMOQ M-H version two weeks later. Table 5.21 shows the intraclass correlation coefficients of each of the items in the DMOQ M-H version. The higher the values nearing 1.00, the more stable the items.

Table 5.21: Intraclass correlation coefficient

Item	ICC (95% CI)
K1	0.746 (0.535 – 0.869)
K2	0.821 (0.664 – 0.909)
K3	1.000 (-)
K4	0.933 (0.867 – 0.967)
K5	0.872 (0.752 – 0.936)
K6	0.810 (0.640 – 0.904)
K7	1.000 (-)
SUSCEP1	1.000 (-)
SUSCEP2	0.775 (0.584 – 0.885)
SUSCEP3	0.937 (0.874 – 0.969)
CUE1	1.000 (-)
CUE2	0.979 (0.958 - 0.990)
BEN1	0.747 (0.537 – 0.869)
BEN2	0.949 (0.897 – 0.975)
BEN3	0.803 (0.619 – 0.901)
BAR1	0.851 (0.704 – 0.927)
BAR2	0.892 (0.788 – 0.946)
BAR3	0.846 (0.694 – 0.924)
BAR4	0.956 (0.910 – 0.978)
BAR5	0.904 (0.810 – 0.952)
SEV1	0.628 (0.362 – 0.801)
SEV2	0.872 (0.753 – 0.936)
SEV3	0.946 (0.892 – 0.973)
SEV4	0.556 (0.254 – 0.759)
SEV5	0.887 (0.781 – 0.944)
HVS1	1.000 (-)
HVS2	0.858 (0.726 – 0.929)
HVS3	0.749 (0.513 – 0.875)
HVS4	0.845 (0.705 – 0.922)

4.5 The validated DMOQ Malay final version

After going through the adaptation, translation and validation processes as previously described, the final DMOQ Malay version includes five subscales with a total of 22 items:

1) Subscale one: "Perceived barriers", which accounted for 18.08% of the total variance. This factor includes six items and reflects the patients perceived barriers to speaking to their relatives about risk reduction of developing T2DM.
2) Subscale two: "Perceived benefits", which accounted for 14.31% of the total variance. This factor includes four items and reflects the patients perceived benefits of speaking to their relatives about risk reduction of developing T2DM.
3) Subscale three: "Perceived severity", which accounted for 9.69% of the total variance. This factor includes three items and reflects the patients' perception of the severity of Diabetes compared to cancer and AIDS.
4) Subscale four: "Perceived susceptibility", which accounted for 8.26% of the total variance. This factor includes three items and reflects perceptions of family risk of Diabetes Mellitus and anxiety about developing the disease in the family.
5) Subscale five: "Knowledge of risk factors", which accounted for 5.997% of the total variance. This factor includes four items and one open-ended question which reflect the patients' knowledge of risk factors and risk reduction of Diabetes Mellitus.

A total of 2 factors and 13 items were removed during the validation process which includes:

i) three items removed during the process of content validity (questions on siblings).

ii) three items removed due to poor factor loadings <0.40 (CUE1, HVS2, HVS3).

iii) five items (K1, K6, K7, SEV2, and SEV5) were removed as there were loaded onto two unidentifiable factors.

iv) one item (HVS1) removed as it did not fit conceptually with the factor it loaded onto.

iv) one open ended question (on 'motivation to cues') was also removed as it did not fit into any of the retained factors.

The reliability analyses showed an internal consistency of Cronbach alpha value of 0.712 which was acceptable with a test-retest analysis of 0.868 which indicated stability of the questionnaire. The validated DMOQ Malay final version which consisted of five factors (representing five concepts) and 22 items is presented in Appendix 8.

CHAPTER 5: DISCUSSION

5.1 Comparison on validation of the DMOQ with other studies

The final DMOQ Malay version was made up of five factors with 22 items which included the following factors which were 1) knowledge of risk factors and risk reduction of developing T2DM, 2) perceived susceptibility, 3) perceived benefits, 4) perceived barriers and 5) perceived severity.

However, the original DMOQ in the English language were made up of seven factors which included 1) knowledge of risk factors of developing T2DM, 2) perceived susceptibility, 3) cues to action, 4) perceived benefits, 5) perceived barriers, 6) perceived severity and 7) health value scale (59). Two factors were removed in this study as the initial seven factor solution of the PCA during the construct validity resulted in these two factors being unidentified and not fitting into any of the concepts of the underlying theoretical framework of the Health Belief Model. Table 6.1 shows a comparison of the subscales and items between the original DMOQ English version and the Malay version.

Table 5.1: Comparison of concepts and items in the original DMOQ English and Malay versions

No	Concept	English version		Malay version	
			Items		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?	4 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?

Table 5.1: Comparison of concepts and items in the original DMOQ English and Malay versions (continued)

No	Concept	English version		Malay version	
			Items		Items
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	
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.

Table 5.1: *Comparison of concepts and items in the original DMOQ English and Malay versions (continued)*

No	Concept	English version		Malay version	
			Items		Items
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	**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 hve your health, you dont have anything. 4. There are any things I care about than my health.	0 items	
		Total	**34 items**	**Total**	**21 items**

The DMOQ has also been translated into the Arabic language (20), however the psychometric analysis results were not published. The internal consistency of the subscales of the original DMOQ English version (20) was compared to the DMOQ Malay version in the following table 5.2.

Table 5.2: Comparison of the DMOQ Malay version with other DMOQ validation studies

		Whitford et al	D.L. Whitford M. Al-Sabbagh	Current study
Year		2009	2010	2016
Language		English	English and Arabic language	Malay language
Sample population		T2DM patients from a hospital registry	T2DM patients from a tertiary Diabetes clinic	T2DM patients in the primary care setting
Sample size		297	201	159
Questionnaire		DMOQ	DMOQ English and (Ireland), Arabic version (Bahrain)	DMOQ Malay version
Sampling method		Random sampling	Convenience sampling	Convenience sampling
Questionnaire administration		Self-administered	Self-administered	Self-administered
Factors obtained			Seven factors	Five factors
Internal consistency (Cronbach alpha)	Perceived severity		0.45	0.810
	Perceived susceptibility		0.72	0.622
	Perceived benefits		0.88	0.666
	Perceived barriers		0.71	0.776
	Cue to action		0.67	-
	Health value scale		0.72	-
				Total : 0.714

The DMOQ Malay version which retained 22 items representing the five concepts is a valid and reliable tool to measure the perception of T2DM patients regarding risk of their offspring in developing T2DM. This is because the DMOQ Malay version has undergone a rigorous validation process in which the content, face and construct validation processes and reliability analysis were conducted according to well established guidelines (45, 46).

The twelve items which were removed represented items from the following concepts: 1) perceived susceptibility (2 items), 2) cues to action (3 items), 3) perceived severity (2 items), 4) Health Value Scale (2 items) and 5) knowledge of risk factors (3 items). The omission of these items should not affect the content validity of the DMOQ Malay version because items from the main four tenets of the Health Belief Model which are perceived barriers, perceived benefits, perceived susceptibility and perceived severity were retained.

5.2 Discussion on the methods of adaptation, translation and validation of this study

5.2.1 Content validity

This study examined the conceptual equivalence of the DMOQ by adopting the approach of consulting a broad range of experts including linguists, health professionals and medical sociologists. This is extremely important to look at whether the items and concepts within the original questionnaire are equally relevant and acceptable in the target population, in this case the Malaysian population.

Investigation of the conceptual equivalence of the DMOQ by the expert committee found that the domains employed in the original DMOQ were equally relevant and important to the concept in the target culture indicating that the construct employed in the original questionnaire is likely to be equally valid in the Malaysian population.

However, the original 34-item DMOQ included questions to assess the perception of T2DM patients on their offspring's and siblings' risk of developing T2DM. T2DM patients were thought to be more likely to introduce health-related actions towards risk reduction to their nucleus family members i.e. their offspring and spouse compared to their siblings. There may also be geographical distance between them which may impede the feasibility of introducing preventive actions towards risk reduction of T2DM (63). Siblings of T2DM patients may also 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 (63).Thus, three items pertaining to risk perception of siblings were removed from the draft DMOQ Malay version at this stage. Moreover, this is supported by the literature which mainly examines risk perceptions of patients towards their offspring developing T2DM (13, 19, 35, 37) and also offspring's views on risk perception of developing T2DM (13, 28, 31, 35).

5.2.2 Translation of the DMOQ English to the Malay language

The cross-cultural adaptation and translation methods of this study followed a comprehensive linguistic translation process according to the recommended guidelines of questionnaire translation and cross cultural adaptation of an instrument (41, 43, 46, 47).

The two translators chosen as forwards translators in this study were native speakers of the Malay language as well as having a good understanding of the original English language. Our first translator was a Medical Registrar with vast experience in dealing with cases of Diabetes Mellitus and good command of the Malay and English language. Our second translator was a linguistic expert who had obtained a Degree in Teaching English as a Second Language (TESL) from the University of Plymouth and currently teaches English in Sekolah Menengah Kampung Jawa, Klang. They produced the forward translations of the DMOQ named the M1 and M2 respectively. The rationale behind choosing one of the forward translators amongst the medical profession was with the intention that one of the translations will capture the conceptual meaning of the questions concerning risk perception of Diabetes Mellitus rather than just being a literal language translation.

Subsequently, reconciliation of both the translated versions (M1 and M2) from both of the translators was carried out to produce a synthesized forward translation (M-S) by the researchers of the study as well as the forward translators to produce a synthesized forward translation M-S.

Thereafter, the synthesized version was back translated independently by another two independent translators who are fluent in the original language with a good understanding of the language of the target population. The two translators chosen for this process of back translation were from a medical and linguistic background, respectively. Our third translator was a Medical Registrar with vast experience in dealing with cases of Diabetes Mellitus and good command of the Malay and English language as she previously resided in the United Kingdom for 8 years. Our fourth translator was a linguistic expert who had obtained a Degree in Teaching English as

a Second Language (TESL) from the University of Plymouth and currently teaches English in Johor. They produced the back translations E1 and E2 respectively. Both E1 and E2 were reviewed by the research team to produce a synthesized back translated version of the DMOQ (E-S).

5.2.3 Face validation

The measurement method mostly used in the DMOQ was of the Likert scales. The Likert scales in the different sections of the DMOQ varied from a 4 to 6 point Likert scale. As a result of the feedback from the face validation, one of the modifications made was to change the Likert scales of the DMOQ Malay version to a uniform odd numbered Likert scale which was the 5 point Likert scale. This was carried out due to the fact that even numbered scale questions have been shown to predispose the participants to choose either a positive or a negative answer (64). The ideal scale for questions is an odd-numbered scale in which there is a balanced number of positive and negative options and also allows respondents to select a neutral option (64).

5.3 Psychometric properties of the DMOQ Malay version

5.3.1 Construct validity of the DMOQ Malay version

EFA was carried out in this study to determine the number of factors and the factor structure (model). The CFA was not performed as it would have required specification of a model a priori, number of factors (53) and also a larger number of sample size with a minimum of at least 300 participants.

Prior to proceeding with factor analysis, the question is whether the data from our study was suitable for factor analysis. It is crucial to have a sufficient sample size to enable factor analysis to be executed (52). The sample size for this study was estimated as sample to variable ratio (SVR) of 5:1 which was considered as adequate.

Our study found that "perceived barriers" was the most significant concept in that it resulted in the highest total variance compared to the other HBM constructs. This was consistent with findings from a study by Becker et al (22) in which the study examined the individual constructs of the HBM from preventive health behaviour studies and sick role behaviour studies between 1974-1984. A significance ratio was constructed which divided the number of positive statistically significant findings for an HBM constructs by the total number of studies reporting significance levels for each construct. "Perceived barriers" proved to be the most powerful of the HBM constructs across the various study designs and behaviours examined. Becker et al cites that "perceived susceptibility" and "perceived benefits" were both equally important overall; however perceived susceptibility was a stronger contributor to preventive health behaviours. "Perceived severity" produced the lowest overall significance ratios. However, our study found that the construct "perceived susceptibility" produced less significant total variance compared to "perceived severity" which was not consistent with findings from Becker et al.

5.3.2 Reliability of the DMOQ Malay version

The Cronbach alpha of this study was 0.714 which was considered an acceptable value. In the field testing of the DMOQ M-H version, we had a total of 159 patients. 31 patients came back for a retest of the DMOQ M-H version two weeks later. Our

clustered data that underwent ICC analysis showed that the DMOQ Malay version was stable over time.

5.4 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. Although the literacy rate has improved significantly over the past years to 96.2% in males and 92.7% in females (65), there is still an undetermined number of Malaysians who are not able to read and understand the Malay language. Therefore, translations of the questionnaire to other languages such as Mandarin and Tamil are needed to give better utilisation.

Another limitation of the study is the convenience sampling method which is vulnerable to sampling bias. It is recognized that a more representative and unbiased sampling method would be to conduct a systematic random sampling of the T2DM patients from a registry to ensure that all T2DM patients would then have an equal chance of being selected for the study. However, a random sampling method of the T2DM attending the NCD unit of KKSB could not be conducted due to the unavailability of an electronic T2DM registry at the unit.

During the adaptation, translation and validation process to produce the final DMOQ-Malay version, the number of items and concepts has considerably reduced due to omission of items. Therefore, the findings from the DMOQ-Malay version may not be comparable to the findings in studies which use the original DMFQ-English version.

5.5 Implications for clinical practice, future research and policy change

The validated DMOQ Malay version can now be utilised to examine the perception of T2DM patients towards the risk of their offspring in developing Diabetes. This information would provide a better understanding on matters related to risk perceptions and potential intervention to reduce this risk. 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.

However, to strengthen the rigor of the DMOQ Malay version for future research, further studies with a larger sample size studying the structured equation modelling (SEM) and confirmatory factor analysis for the DMOQ Malay version is recommended.

Future research may also include the adaptation, translation and validation of the DMOQ-R which is meant to assess the risk perceptions of developing T2DM among the first degree relatives (offspring and siblings) of T2DM patients. Understanding risks perception from the offspring's or the siblings' viewpoint would then provide opportunity to identify individuals who are willing to be enrolled in Diabetes Mellitus prevention programmes and whether these strategies would be accepted.

CHAPTER 6: CONCLUSION

In conclusion, this study found that the DMOQ Malay version is a valid and reliable research tool which can be used to assess risk perception among T2DM patients in Malaysia. Recommended future research also includes the adaptation, translation and validation of the DMOQ-R, which is meant to assess the risk perceptions of developing T2DM among the first degree relatives of T2DM patients. Assessing risks perception from the first degree relatives' viewpoint would provide a holistic understanding of this complex matter. This information is vital to aid health care professionals and policy makers in developing effective training strategies for the T2DM patients to become the 'change agent' to prevent their offspring from developing T2DM and to determine whether their offspring would accept these preventive strategies.

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APPENDICES

Appendix 1: Original English Version of the Diabetes Mellitus in the Offspring Questionnaire (DMOQ)

Code:

QUESTIONNAIRE

PLEASE ANSWER THESE QUESTIONS EVEN IF YOU DO NOT WISH TO COMPLETE THE REST OF THE QUESTIONNAIRE.

Do you have any relatives to whom you can give a questionnaire? Please tick the appropriate box. Yes ☐ No ☐

If you answered yes, please indicate the number of relatives to whom you have given a questionnaire. _____

Section 1

There is a question on Diabetes below. It is followed by a number of choices. You should select from these choices one or more that you think correctly answers the question. Do not worry if you cannot answer the question; just tick the box next to "I don't know". Please do not try finding out the answer before completing this section or try guessing the answer.

For example,

Most people normally travel to and from work by…

- ☑ Bus/Train
- ☐ Horse
- ☑ Car/Motorcycle
- ☑ Bicycle
- ☐ Airplane
- ☐ I don't know

1. Which of the following factors make a person more likely to develop Type 2 Diabetes?

- ☐ Having a parent with type 2 Diabetes
- ☐ Being overweight
- ☐ High salt intake
- ☐ Taking little or no exercise
- ☐ Being over 40 years of age
- ☐ Having a brother or sister with type 2 Diabetes
- ☐ I don't know

IMPORTANT NOTE: The questions in sections 2, 3, and 4 refer to your children and brothers and sisters who do not have Diabetes. If you do not have any children or brothers and sisters or if your children or brothers and sisters all have Diabetes, please leave the questions concerning these relatives blank.

Section 2

Please circle the number that represents your answer to the following questions. For example, if you thought something was quite likely, you would circle the number 3.

	Not at all Likely	Not very likely	Quite likely	Very likely
1. How likely do you think it is that any of your children will get Diabetes sometime in their life?	1	2	3	4
2. How likely do you think it is that any of your brothers and sisters will get Diabetes sometime in their life?	1	2	3	4
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?	1	2	3	4

	No	Rarely	Sometimes	Often
4. Do you worry that your children might get Diabetes sometime in their life?	1	2	3	4
5. Do you worry that your brothers and sisters might get Diabetes sometime in their life?	1	2	3	4

Section 3

Please, tick the box beside your answer.

1. Have you talked to any of your children about the possibility of them getting Diabetes?

None ☐ Some ☐ All ☐

2. Have you talked to any of your brothers and sisters about the possibility of them getting Diabetes?

None ☐ Some ☐ All ☐

Section 4

1. Please circle the number that corresponds to your level of agreement with the following statement.

If I were offered training in how to speak to my children and brothers and sisters about their risk of getting Diabetes and what they can do to reduce this risk, I would be willing to speak to them about this.

Strongly Disagree	Moderately disagree	Slightly disagree	Slightly agree	Moderately agree	Strongly agree
1	2	3	4	5	6

2. What would help you speak to your relatives about their risk of getting Diabetes and what they can do to reduce this risk?

_____

_____

_____

3. Listed below are some possible benefits and barriers related to speaking to your relatives about their risk of getting Diabetes and what they can do to reduce this risk. Please circle the number that corresponds to your level of agreement with each statement.

	Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree
Benefits						
1. Make my relatives more aware of the importance of diet and exercise.	1	2	3	4	5	6
2. Encourage them to make some changes to their lifestyle.	1	2	3	4	5	6

3. Help prevent them developing Diabetes.	1	2	3	4	5	6
	Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree
Barriers						
1. I do not have a healthy lifestyle myself.	1	2	3	4	5	6
2. I do not have much contact with my relatives.	1	2	3	4	5	6
3. My relatives are not open to advice from me.	1	2	3	4	5	6
4. They do not see Diabetes as a serious illness.	1	2	3	4	5	6
5. They do not believe they are at risk of getting Diabetes.	1	2	3	4	5	6

Section 5

1. How do you think a person can reduce his/her risk of getting Diabetes?

Section 6

Please circle a number on each of the scales to indicate how serious you think the following problems are.

	Not Serious	Mildly serious	Quite serious	Serious	Very serious
1. Cancer	1	2	3	4	5
2. Flu	1	2	3	4	5
3. Diabetes	1	2	3	4	5
4. AIDS	1	2	3	4	5
5. Arthritis	1	2	3	4	5

Section 7

Indicate the extent to which you agree with the following four statements, using the scale below. Write the appropriate number in the blank space to the right of each statement.

Strongly agree		Moderately agree		Moderately disagree		Strongly disagree
1	2	3	4	5	6	7

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 many things I care about more than my health. _____

Section 8

The questions in this section relate to your family history of Diabetes. Please indicate if your mother or father or any of your brothers and sisters has/had Diabetes by ticking the "Yes", "No" or "I don't know" box.

	Yes	No	I don't know
1. My mother			
2. My father			
3. My brothers and sisters			

Section 9

1. When were you diagnosed with Diabetes? _____ Month _____ Year

2. How is your Diabetes treated?

☐ Diet

☐ Diet and tablets

☐ Diet and insulin

☐ Diet, tablets, and insulin

3. Are you male ☐ or female? ☐

4. What age are you? _____

5. Are you:

☐ Married/living with your partner

☐ Widowed

☐ Separated/divorced

☐ Single

6. At what age did you finish full-time education? _____

7. What is your occupation? If you are retired, please write this down as well as your previous occupation. If you are a homemaker/housewife, please write this down as well as the occupation of the main breadwinner in your household.

_____

THANK YOU FOR TAKING THE TIME TO COMPLETE THIS QUESTIONNAIRE

Appendix 2: Permission from the Developer of the Original DMOQ

PERMISSION FROM THE ORIGINAL AUTHOR OF THE DIABETES MELLITUS IN THE FAMILY QUESTIONNAIRE (DMFQ) AND DIABETES MELLITUS IN THE FAMILY (relatives) QUESTIONNAIRE (DMFQ-r)

I hereby give permission to Dr Siti Fatimah binti Badlishah Sham to proceed with the translation and validation process of the DMFQ and DMFQ-r from the original English to the Malay language.

Copies of the original DMFQ and DMFQ-r questionnaires and their published articles have been forwarded prior to this and I look forward to the findings of this study.

Prof David L Whitford
MD (Cantab), MA (Cantab), MB BS, FRCGP, DRCOG
Head of Department of Family & Community Medicine
(also Chair of Research Committee; Director Quality Assurance)

RCSI Bahrain
P.O. Box 15503,
Adilya,
Bahrain

Email: dwhitford@rcsi-mub.com
Tel: 17351450 Ext 3350

Appendix 3: DMOQ-MH Version

Soal Selidik Kencing Manis di dalam Keluarga

SOAL SELIDIK

DEMOGRAFI

1. Berapa lamakah anda menghidap penyakit kencing manis? ___ bulan ____ tahun

2. Bagaimanakah penyakit kencing manis anda dirawat?
   - ☐ Mengawal pemakanan sahaja
   - ☐ Mengawal pemakanan dan ubat
   - ☐ Mengawal pemakanan dan insulin
   - ☐ Mengawal pemakanan, ubat dan insulin

3. Adakah anda mempunyai saudara-mara (seperti di bawah) yang **menghidap** kencing manis?

   ☐ Ibu saya
   ☐ Ayah saya
   ☐ Adik beradik saya
   ☐ Anak-anak saya
   Jika ya, nyatakan bilangan ____ orang

   Sila nyatakan bilangan ahli keluarga (anak atau adik-beradik) yang **tidak menghidap** penyakit kencing manis. _____ orang

4. Jantina: Lelaki ☐ Perempuan ☐

5. Umur: ____ tahun

6. Keturunan:
   - ☐ Melayu
   - ☐ Cina
   - ☐ India
   - ☐ Bumiputera Sabah dan Sarawak
   - ☐ Lain-lain

7. Taraf perkahwinan:
   - ☐ Berkahwin
   - ☐ Kematian pasangan
   - ☐ Bercerai / Berpisah
   - ☐ Belum berkahwin

8. Tahap tertinggi pengajian:
   ☐ Tidak bersekolah
   ☐ Sekolah rendah
   ☐ Sekolah menengah
   ☐ Sijil/Diploma/Ijazah

Bahagian 1

1. Di antara faktor-faktor berikut, yang manakah akan menyebabkan seseorang itu berkemungkinan mendapat penyakit kencing manis (Type 2 Diabetes)? *(Anda boleh memilih lebih dari satu jawapan)*

   ☐ Salah seorang ibu/bapa menghidap penyakit kencing manis
   ☐ Berat badan berlebihan
   ☐ Pengambilan garam berlebihan
   ☐ Kurang/Tiada senaman
   ☐ Umur melebihi 40 tahun
   ☐ Mempunyai adik-beradik (lelaki atau perempuan) yang menghidap kencing manis
   ☐ Saya tidak tahu

Bahagian 2

Sila bulatkan jawapan anda.

	Tidak mungkin sama sekali	Tidak mungkin	Mungkin	Kemungkinan besar
1. Adakah anak-anak anda berkemungkinan menghidap penyakit kencing manis pada masa yang akan datang?	1	2	3	4
2. Adakah seseorang itu akan menghidap penyakit kencing manis sekiranya ahli keluarga mereka tidak menghidapi penyakit ini?	1	2	3	4

	Tidak risau	Jarang-jarang risau	Kadang-kadang risau	Selalu risau
3. Adakah anda risau anak-anak anda mungkin akan menghidap penyakit kencing manis pada masa yang akan datang?	1	2	3	4

Bahagian 3

Sila tandakan '√' pada kotak yang berkenaan.

1. Pernahkah anda bercakap dengan anak-anak anda tentang kemungkinan mereka mendapat penyakit kencing manis?

   ☐ Tidak pernah bercakap
   ☐ Bercakap dengan sebahagian anak-anak
   ☐ Bercakap dengan semua anak-anak

Sila bulatkan jawapan anda.

2. Jika anda ditawarkan latihan bercakap dengan anak-anak tentang risiko kencing manis dan apa yang mereka boleh lakukan untuk mengurangkan risiko tersebut, adakah anda sanggup menerima latihan ini?

Sangat tidak sanggup	Sedikit sanggup	Sanggup	Sangat sanggup
1	2	3	4

3. Apakah yang akan dapat membantu anda untuk bercakap kepada anak-anak anda tentang risiko mereka untuk mendapat kencing manis?

Bahagian 4

Di bawah ini disenaraikan beberapa manfaat dan halangan bercakap dengan anak-anak tentang risiko mereka mendapat penyakit kencing manis. *Sila bulatkan jawapan anda.*

	Manfaat	Sangat tidak setuju	Tidak setuju	Setuju	Sangat setuju
1.	Membuatkan anak-anak saya lebih mementingkan penjagaan makanan dan senaman.	1	2	3	4
2.	Menggalakkan anak-anak saya untuk mengubah gaya hidup mereka.	1	2	3	4
3.	Membantu anak-anak mencegah daripada menghidap penyakit kencing manis.	1	2	3	4
	Halangan	Sangat tidak setuju	Tidak setuju	Setuju	Sangat setuju
1.	Saya sendiri tidak mengamalkan gaya hidup yang sihat.	1	2	3	4
2.	Saya tidak banyak berhubung dengan anak-anak.	1	2	3	4
3.	Anak-anak saya kurang menerima nasihat daripada saya.	1	2	3	4
4.	Anak-anak saya tidak menganggap penyakit kencing manis sebagai sesuatu penyakit yang serius.	1	2	3	4
5.	Anak-anak saya tidak percaya bahawa mereka berisiko untuk menghidap penyakit kencing manis.	1	2	3	4

Bahagian 5

Sila bulatkan jawapan anda mengikut pandangan anda tentang tahap serius penyakit-panyakit yang berikut:

		Tidak serius	Sedikit serius	Sederhana serius	Serius	Sangat serius
1.	Kanser	1	2	3	4	5
2.	Selsema	1	2	3	4	5
3.	Kencing manis	1	2	3	4	5
4.	AIDS	1	2	3	4	5
5.	Sakit sendi	1	2	3	4	5

Bahagian 6

Sila bulatkan jawapan anda.

		Sangat tidak setuju	Tidak setuju	Setuju	Sangat setuju
1.	Tiada yang lebih penting daripada mempunyai kesihatan yang baik.	1	2	3	4
2.	Kesihatan yang baik memainkan peranan kecil dalam kehidupan yang bahagia.	1	2	3	4
3.	Sekiranya anda tidak mempunyai kesihatan yang baik, anda tidak punyai apa-apa.	1	2	3	4
4.	Saya lebih mementingkan perkara-perkara lain berbanding dengan kesihatan saya.	1	2	3	4

TERIMA KASIH DI ATAS KESUDIAN ANDA UNTUK MENGHABISKAN SOAL SELIDIK INI.

Appendix 4: Patient Information Sheet (Malay and English Language)

Borang REC 2/2012 BM

Borang Maklumat untuk Subjek

(Translasi dan Kesahan ke dalam Bahasa Melayu; Soal selidik tentang kencing manis di dalam keluarga)

Pengenalan Kajian

Borang ini bertujuan untuk memberikan maklumat yang lebih terperinci tentang kajian ini. Sebagai pesakit Diabetes anda dialu-alukan untuk mengambil bahagian.

Tujuan Kajian

Soal selidik ini bertujuan untuk mengkaji persepsi pesakit Diabetes serta ahli keluarga mereka terhadap risiko menghidap penyakit Diabetes dan langkah-langkah yang diambil oleh pesakit dan keluarga untuk mengurangkan risiko menghidap penyakit ini.

Prosedur Kajian

Pesakit yang menghidap Diabetes dari klinik Diabetes dan ahi keluarga yang berumur 18 tahun ke atas akan dijemput untuk menyertai kajian ini. Pesakit dan ahli kelurga akan diberi borang soal selidik untuk dijawab. Sebarang soalan yang tidak difahami hendaklah diajukan kepada penyelidik.

Penyertaan dalam Kajian

Penyertaan anda di dalam kajian ini adalah secara sukarela. Anda berhak menolak tawaran penyertaan ini atau menarik diri daripada kajian ini pada bila-bila masa tanpa sebarang penalti.

Manfaat Kajian

Maklumat yang didapati dari kajian ini akan memanfaatkan penyelidik kajian ini, Kerajaan Malaysia, doktor dan individu dalam kemajuan ilmu dan amalan perubatan pada masa depan.

Sekiranya anda mempunyai sebarang pertanyaan mengenai kajian ini atau hak-hak anda, sila hubungi penyelidik, Dr Siti Fatimah binti Badlishah Sham di talian 03-61264600.

Kerahsiaan

Maklumat perubatan anda akan dirahsiakan oleh penyelidik dan tidak akan didedahkan melainkan jika ia dikehendaki oleh undang-undang. Dengan menandatangani borang persetujuan ini, anda membenarkan penelitian rekod, penganalisaan dan penggunaan data hasil dari kajian ini.

Subjects Information Sheet

(Diabetes Mellitus in the offspring questionnaire; Translation and Validation of the Malay version)

Introduction of Study

This form aims to provide in-depth information about this study. You as a patient with Diabetes are invited to participate in this study.

Purpose of Study

The aim of this questionnaire is to explore the perception of diabetic patients and their relatives on the risk and prevention of Diabetes in their family members.

Study Procedure

Patients with Diabetes from the Diabetes Clinic and their relatives will be invited to participate in the study and be given questionnaires to fill.

Any queries regarding the questionnaire should be informed to the researcher.

Participation in Study

Your participation in this study is entirely voluntary. You may refuse to take part in the study or you may withdraw yourself from participation in the study at anytime without penalty.

Benefit of Study

Information obtained from this study will benefit the researchers, Government of Malaysia, doctors and individuals for the advancement of knowledge and practice of medicine in future.

If you have any question about this study or your rights, please contact the investigator, Dr Siti Fatimah Badlishah Sham at telephone number 0361264600.

Confidentiality

Your medical information will be kept confidential by the investigators and will not be made public unless disclosure is required by law.

By signing this consent form, you will authorize the review of records, analysis and use of the data arising from this study.

Appendix 5: Patient Consent Form (Malay and English Language)

Borang REC 3/2012 BM

Borang Izin

Untuk menyertai kajian ini, anda atau penjaga sah anda diperlukan menandatangani Borang Izin ini.

Saya dengan ini mengesahkan yang saya telah memenuhi syarat umur dan dalam keadaan yang berkeupayaan untuk bertindak untuk diri sendiri/ *sebagai penjaga yang sah dalam perkara-perkara yang berikut:

1. Saya memahami ciri-ciri dan skop kajian ini.
2. Saya telah membaca dan memahami semua syarat penyertaan kajian ini.
3. Saya berpuas hati dengan jawapan pada kemusykilan saya tentang kajian ini.
4. Saya secara sukarela bersetuju menyertai kajian ini dan mengikuti segala atur cara dan memberi maklumat yang diperlukan kepada penyelidik seperti yang dikehendaki.
5. Saya boleh menarik diri daripada kajian ini pada bila-bila masa tanpa memberi sebab.
6. Saya telah pun menerima satu salinan Borang Maklumat dan Borang Izin.
7. Kecuali kecederaan yang disebabkan kelalaian dan kecuaian oleh penyelidik, saya dengan ini melepaskan dan menggugurkan UiTM dan semua penyelidik dari semua laibiliti berhubung dengan, wujud dari atau berkaitan dengan penyertaan saya dan bersetuju untuk menjadikan mereka tidak bertanggunggan terhadap apa-apa kerugian atau kecederaan yang mungkin akan saya tanggung disebabkan penyertaan saya.

Nama Subjek/Penjaga Sah Tandatangan

No. Kad Pengenalan Tarikh

Nama Saksi Tandatangan

No. Kad Pengenalan Tarikh

Nama Pengambil Izin Tandatangan

No. Kad Pengenalan Tarikh

Consent Form

To become a subject in the research, you or your legal guardian is advised to sign this Consent Form.

I herewith confirm that I have met the requirement of age and am capable of acting on behalf of myself /* as a legal guardian as follows:

1. I understand the nature and scope of the research being undertaken.
2. I have read and understood all the terms and conditions of my participation in the research.
3. All my questions relating to this research and my participation therein have been answered to my satisfaction.
4. I voluntarily agree to take part in this research, to follow the study procedures and to provide all necessary information to the investigators as requested.
5. I may at any time choose to withdraw from this research without giving reasons.
6. I have received a copy of the Subjects Information Sheet and Consent Form.
7. Except for damages resulting from negligent or malicious conduct of the researcher(s), I hereby release and discharge UiTM and all participating researchers from all liability associated with, arising out of, or related to my participation and agree to hold them harmless from any harm or loss that may be incurred by me due to my participation in the research.

Name of Subject/Legal Guardian	Signature
I.C No	Date
Name of Witness	Signature
I.C No	Date
Name of Consent Taker	Signature
I.C No	Date

Appendix 6: Coding of the Items of the DMOQ M-H Version

No	Concept		DMOQ M-H version	Coding
1	**Knowledge of Diabetes risk factors**	7 items	1.Having a parent with type 2 Diabetes	K1
			2. Being overweight	K2
			3.High salt intake	K3
			4.Taking little or no exercise	K4
			5.Being over 40 years of age	K5
			6.Having a brother or sister with type 2 Diabetes	K6
			7.I don't know	K7
2	**Perceived susceptibility**	3 items	1. How likely do you think it is that any of your children will get Diabetes sometime in their life?	SUSCEP1
			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?	SUSCEP2
			3. Do you worry that your children might get Diabetes sometime in their life?	SUSCEP3
3	**Cues to action**	2 items	1. Have you ever talked to any of your children about the possibility of them getting Diabetes?	CUE1
			2. 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.	CUE2
4	**Perceived benefits**	3 items	1. Make my relatives more aware of the importance of diet and exercise.	BEN1
			2. Encourage them to make some changes to their lifestyle.	BEN2
			3. Help prevent them developing Diabetes.	BEN3
5	**Perceived barriers**	5 items	1.I do not have a healthy lifestyle myself.	BAR1
			2.I do not have much contact with my relatives.	BAR2
			3.My relatives are not open to advice from me.	BAR3
			4.They do not see Diabetes as a serious illness.	BAR4
			5. They do not believe they are at risk of getting Diabetes.	BAR5
6	**Perceived severity**	5 items	Please indicate how serious you think the following problems are:	
			1.Cancer	SEV1
			2.Flu	SEV2
			3.Diabetes	SEV3
			4.AIDS	SEV4
			5.Arthritis	SEV5
7	**Health Value Scale**	4 items	1.There is nothing more important than good health.	HVS1
			2.Good health is only of minor importance in a happy life.	HVS2
			3. If you don't hve your health, you dont have anything.	HVS3
			4.There are any things I care about than my health.	HVS4
	Total	29 items		

Appendix 7: NMRR Ethics Committee Approval Letter

JAWATANKUASA ETIKA & PENYELIDIKAN PERUBATAN
(Medical Research & Ethics Committee)
KEMENTERIAN KESIHATAN MALAYSIA
d/aInstitut Pengurusan Kesihatan Tel. : 03 2282 9082/03 2282 9085
Jalan Rumah Sakit, Bangsar 03 2287 4032/03 2282 0491
59000 Kuala Lumpur Faks: 03 22828072/03 2282 0015

Ruj. Kami: (5) KKM/NIHSEC/P15-1059
Tarikh: 17 August 2015

SITI FATIMAH BINTI BADLISHAH SHAM
FAKULTI PERUBATAN,
UNIVERSITI TEKNOLOGI MARA

RAJNA A/P R. ANTHONY
DEPARTMENT OF RESOURCE MANAGEMENT AND CONSUMER STUDIES
UNIVERSITI PUTRA MALAYSIA (UPM)

Tuan/Puan

NMRR-14-1861-22954 (IIR)
EVALUATING PERCEPTIONS OF T2DM PATIENTS TOWARDS RISK OF DEVELOPING T2DM AND POSSIBILITY OF FAMILY INTERVENTION IN THEIR FIRST DEGREE RELATIVES

Lokasi Kajian: Klinik Kesihatan Sungai Buloh

Dengan hormatnya perkara di atas adalah dirujuk.

2. Jawatankuasa Etika & Penyelidikan Perubatan (JEPP), Kementerian Kesihatan Malaysia (KKM) tiada halangan, dari segi etika, ke atas pelaksanaan kajian tersebut. JEPP mengambil maklum bahawa kajian tersebut tidak mempunyai intervensi klinikal ke atas subjek dan hanya melibatkan borang kaji selidik sahaja.

3. Segala rekod dan data adalah **SULIT** dan hanya digunakan untuk tujuan kajian ini dan semua isu serta prosedur mengenai ***data confidentiality*** mesti dipatuhi. Kebenaran daripada Pegawai Kesihatan Daerah/Pengarah Hospital dan Ketua-Ketua Jabatan atau pegawai yang bertanggung jawab disetiap lokasi kajian di mana kajian akan dijalankan mesti diperolehi sebelum kajian dijalankan. Tuan/Puan perlu akur dan mematuhi keputusan tersebut.

4. Tuan/Puan perlu menghantar dokumen-dokumen seperi berikut selepas mendapat kelulusan etika . Borang-borang berkaitan boleh dimuat turun daripada laman web MREC (*http://www.nih.gov.my/mrec*).

I. Laporan tamat kajian pada penghujung kajian.
II. Laporan mengenai *'All adverse events, both serious and unexpected'/Protocol Deviation* atau *Violation* kepada Jawatankuasa Etika & Penyelidikan Perubatan, KKM jika berkenaan.
III. Memaklumkan jika terdapat pindaan keatas sebarang dokumen kajian

5. Sila ambil maklum bahawa sebarang urusan surat-menyurat berkaitan dengan penyelidikan ini haruslah dinyatakan nombor rujukan surat ini untuk melicinkan urusan yang berkaitan.

Sekian terima kasih.

BERKHIDMAT UNTUK NEGARA

Saya yang menurut perintah,

DATO' DR CHANG KIAN MENG
Pengerusi
Jawatankuasa Etika & Penyelidikan Perubatan
Kementerian Kesihatan Malaysia

Cc

Pegawai Kesihatan
Klinik Kesihatan Sungai Buloh

Appendix 8: University Ethics Committee Approval Letter

Institut Pengurusan Penyelidikan
Research Management Institute

Universiti Teknologi MARA
40450 Shah Alam, Selangor, MALAYSIA
Tel: (+603) 5544 2094 / 2080
Fax: (+603) 5544 2096 / 2767

UNIVERSITI TEKNOLOGI MARA

Reference : 600-RMI (5/1/6)
Date : 29 September 2014

Dr Siti Fatimah binti Badlishah Sham
Faculty of Medicine Selayang Campus
Universiti Teknologi MARA
Jalan Prima Selayang 7
68100 Batu Caves
Selangor

Dear Dr Siti Fatimah,

ETHICS APPROVAL BY UiTM RESEARCH ETHICS COMMITTEE – Diabetes Mellitus in the Family Questionnaire (DMFQ); Translation and validation of the Malay version

Thank you for your research ethics application and presentation on 23 September 2014. With pleasure we would like to inform that the UiTM Research Ethics Committee had deliberated your proposal.

The REC members attending the above meeting are shown below:

Name	REC Membership	Designation
Professor Dr HadariahBahron	Chairman	Assistant Vice Chancellor, Research Management Institute (RMI), UiTM
Professor Dr Nafeeza Mohd Ismail	Member	Dean, Faculty of Medicine, UiTM
Professor Dr Mohamed Ismail Mohamed Noor	Member	Dean, Faculty of Dentistry, UiTM
Professor Dr Zainuddin Merican Md Hashim Merican	Member	Professor, College University Medical Science (Pharmacology)
Professor Dr Karis Misiran	Member	Professor, Faculty of Medicine, UiTM
Professor Dr Aishah Adam	Member	Dean, Faculty of Pharmacy, UiTM
Associate Professor Dr Jamaluddin Mahmud	Member	Deputy Dean, Faculty of Mechanical Engineering, UiTM
Dato' Mohamed Dahan Abdul Latif	Member	Chairman, Flight Solutions Sdn. Bhd.
Dr Zainal Abidin Abdul Majeed	Member	Head, Integrity Premier Malaysia
Datin Dr Hjh Sarina Md Yusoff	Member	Head of Postgraduate Studies, Faculty of Sport Science & Recreation, UiTM
Dr Adriana Ismail	Member	Senior Lecturer, Faculty of Health Sciences, UiTM
Dr Fadilah Abd Rahman	Member	Senior Lecturer, ACIS, UiTM

We hereto agreed to grant the Research Ethics Approval for the said study.

Thank you.

Yours truly,

PROFESSOR DR HADARIAH BAHRON
Assistant Vice Chancellor (Research)
Chairman of UiTM Research Ethics Committee

c.c.: Dean
Faculty of Medicine
UniversitiTeknologi MARA
40450 Shah Alam
Selangor Darul Ehsan

Appendix 9: The Diabetes Mellitus in the Offspring Questionnaire (DMOQ): The Malay Version

SOAL SELIDIK KENCING MANIS DI DALAM ANAK-ANAK

DEMOGRAFI

1. Berapa lamakah anda menghidap penyakit kencing manis?

_____ bulan _____ tahun

2. Bagaimanakah penyakit kencing manis anda dirawat?
   ☐Mengawal pemakanan sahaja
   ☐Mengawal pemakanan dan ubat
   ☐Mengawal pemakanan dan insulin
   ☐Mengawal pemakanan, ubat dan insulin

3. Adakah anda mempunyai saudara-mara (seperti di bawah) yang **menghidap** kencing manis?

   ☐Ibu saya
   ☐Ayah saya
   ☐Adik beradik saya

   Sila nyatakan bilangan anak yang **tidak menghidap** penyakit kencing manis.
   _____ orang

4. Jantina: Lelaki☐ Perempuan☐

5. Umur: _____ tahun

6. Keturunan:
   ☐Melayu ☐Bumiputera Sabah dan Sarawak
   ☐Cina ☐Lain-lain
   ☐India

7. Taraf perkahwinan:
   ☐Berkahwin ☐Bercerai / Berpisah
   ☐Kematian pasangan ☐Belum berkahwin

8. Tahap tertinggi pengajian:
   ☐Tidak bersekolah ☐Sekolah menengah
   ☐Sekolah rendah ☐Sijil/Diploma/Ijazah

Bahagian 1

1. Di antara faktor-faktor berikut, yang manakah akan menyebabkan seseorang itu berkemungkinan mendapat penyakit kencing manis (Type 2 Diabetes)?

   (Anda boleh memilih lebih dari satu jawapan)

   ☐Berat badan berlebihan
   ☐Pengambilan garam berlebihan
   ☐Kurang/Tiada senaman
   ☐Umur melebihi 40 tahun

2. Bagaimanakah anda rasa seseorang itu boleh mengurangkan risikonya untuk mendapat kencing manis?

   _____

   _____

Bahagian 2

Sila bulatkan jawapan anda.

	Tidak mungkin sama sekali	Tidak mungkin	Neutral	Mungkin	Kemungkinan besar
1. Adakah anak-anak anda berkemungkinan menghidap penyakit kencing manis pada masa yang akan datang?	1	2	3	4	5
2. Adakah seseorang itu akan menghidap penyakit kencing manis sekiranya ahli keluarga mereka tidak menghidapi penyakit ini?	1	2	3	4	5
	Tidak risau sama sekali	Tidak risau	Neutral	Kadang-kadang risau	Selalu risau
3. Adakah anda risau anak-anak anda mungkin akan menghidap penyakit kencing manis pada masa yang akan datang?	1	2	3	4	5

	Sangat tidak setuju	Tidak setuju	Neutral	Setuju	Sangat setuju
4. Tiada yang lebih penting daripada mempunyai kesihatan yang baik	1	2	3	4	5

Bahagian 3

Sila bulatkan jawapan anda.

1. Jika anda ditawarkan latihan bercakap dengan anak-anak tentang risiko kencing manis dan apa yang mereka boleh lakukan untuk mengurangkan risiko tersebut, adakah anda sanggup menerima latihan ini?

Sangat tidak sanggup	Tidak sanggup	Neutral	Sanggup	Sangat sanggup
1	2	3	4	5

Di bawah ini disenaraikan beberapa **manfaat** bercakap dengan anak-anak anda tentang risiko mereka mendapat penyakit kencing manis.

Sila bulatkan jawapan anda.

	Manfaat	Sangat tidak setuju	Tidak setuju	Neutral	Setuju	Sangat setuju
1.	Membuatkan anak-anak saya lebih mementingkan penjagaan makanan dan senaman.	1	2	3	4	5
2.	Menggalakkan anak-anak saya untuk mengubah gaya hidup mereka.	1	2	3	4	5
3.	Membantu anak-anak mencegah daripada menghidap penyakit kencing manis.	1	2	3	4	5

Bahagian 4

Sila bulatkan jawapan anda mengikut pandangan anda tentang tahap serius penyakit-panyakit yang berikut:

		Tidak serius	Sedikit serius	Sederhana serius	Serius	Sangat serius
1.	Kanser	1	2	3	4	5
2.	Kencing manis	1	2	3	4	5
3.	AIDS	1	2	3	4	5

Bahagian 5

Di bawah ini disenaraikan beberapa **halangan** bercakap dengan anak-anak anda tentang risiko mereka mendapat penyakit kencing manis. *Sila bulatkan jawapan anda.*

	Halangan	Sangat tidak setuju	Tidak setuju	Neutral	Setuju	Sangat setuju
1.	Saya sendiri tidak mengamalkan gaya hidup yang sihat.	1	2	3	4	5
2.	Saya tidak banyak berhubung dengan anak-anak.	1	2	3	4	5
3.	Anak-anak saya kurang menerima nasihat daripada saya.	1	2	3	4	5
4.	Anak-anak saya tidak menganggap penyakit kencing manis sebagai sesuatu penyakit yang serius.	1	2	3	4	5
5.	Anak-anak saya tidak percaya bahawa mereka berisiko untuk menghidap penyakit kencing manis.	1	2	3	4	5
6.	Saya lebih mementingkan perkara-perkara lain berbanding dengan kesihatan saya.	1	2	3	4	5

TERIMA KASIH DI ATAS KESUDIAN ANDA MENGHABISKAN SOAL SELIDIK INI

PART 2

THE PERCEPTIONS OF T2DM PATIENTS TOWARDS THE RISK AND PREVENTION OF T2DM IN THEIR OFFSPRING

CHAPTER 1: INTRODUCTION

Diabetes mellitus is one of the world's commonest non-communicable diseases (NCDs) and the prevalence is set to rise globally (1). According to the International Diabetes Federation 7th edition report, the prevalence of diabetes is estimated to increase from 415 million in 2015 to 642 million by the year 2040 (2). In Malaysia, the overall prevalence of diabetes mellitus among adults of 18 years and above was reported at 17.5% by the National Health Morbidity Survey in 2015 (3).

Type 2 diabetes mellitus (T2DM) results from a combination of genetic and lifestyle factors (4, 5). First degree relatives (siblings and offspring) of patients with T2DM are found to have an increased risk of developing the disease (6). A study 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 (7). This is equivalent to an absolute risk of 20-40% of developing T2DM in the offspring of one parent with T2DM.

T2DM is a concerning public health issue and health professionals are working towards its prevention by targeting high-risk groups such as offspring or individuals with a family history of T2DM. A starting point to making changes in the family on a smaller and modest scale is to encourage patients with diabetes to become the health promoter within the family to talk about risk of diabetes with their first-degree family members (8). It is hoped that they would subsequently be the intervention agent within the family to bring change in the lifestyle of the family members as a mean of prevention of their offspring in developing T2DM.

Hence, ascertaining risk perception of T2DM patients who have offspring is important prior to introducing preventive lifestyle intervention. Measuring risk perception of developing T2DM among offspring of patients with T2DM is crucial to identify individuals who are willing to

motivate their offspring to adopt risk-reducing behaviour and to accept diabetes mellitus prevention strategies (9).

A number of studies have assessed knowledge in the T2DM population and offspring of T2DM patients concerning diabetes mellitus, its risk factors and their perception towards the risk and prevention of T2DM. Some studies have demonstrated that T2DM patients and offspring of T2DM patients were aware of the seriousness and risks of diabetes (10-13). Other studies have shown that parental history of T2DM were strongly associated with increased perceived risk of developing T2DM (13-17). Further studies investigated the factors from Health Belief Model and the willingness of T2DM patients to participate in diabetes prevention strategies (10, 17, 18).

Whitford et. al. (18) studied the risk perception of developing T2DM and the willingness of T2DM patients and their first degree relatives to speak to their offspring about the risk factors of T2DM and its preventive measures among the Irish population. Two questionnaires were developed based on the parameters of the Health Belief Model to assess these parameters (8, 19) named the Diabetes Mellitus in the Family Questionnaire (DMFQ) and the Diabetes Mellitus in the Family Questionnaire - Relatives (DMFQ-R). The two questionnaires assess the risk perception among T2DM patients and first-degree relatives of T2DM patients respectively.

The DMFQ was recently adapted, translated and validated in the Malay language. The original 34-item DMFQ included questions to assess the perception of T2DM patients on their offspring's and siblings' risk of developing T2DM. However, T2DM patients were thought to be more likely to introduce health-related actions towards risk reduction to their nucleus family members i.e. their offspring and spouse compared to their siblings. Therefore, three items pertaining to risk perception of siblings were removed from the questionnaire. In total, 12 items were removed during the whole process of adaptation, translation and

validation, which included a further three items being removed due to poor factor loadings of <0.40 following the EFA. Subsequent to rotation of the matrix with a seven factor solution, five items which loaded onto two factors which were not interpretable according to the underlying conceptual framework were also removed. One open ended question was also removed as it did not fit into any of the retained concepts. The final Malay version of the questionnaire consisted of five concepts and 22 items and the questionaire was renamed as the Diabetes Mellitus in the Offspring Questionnaire (DMOQ). The Cronbach alpha was 0.714 which meant an acceptable internal consistency and the test-retest analysis was also consistent over time.

The DMOQ Malay version is a valid and reliable research tool which can be used to assess the risks perception among T2DM patients in Malaysia. To date, the perception of T2DM patients towards the risk of their offspring in developing T2DM has never been evaluated in the Malaysian context. This information is vital to aid health care professionals and policy makers in developing effective training strategies for the T2DM patients to become the 'agent of change' to prevent their offspring from developing T2DM. Therefore, the aim of this part of the study was to evaluate the perception of T2DM patients on the risk of their offspring in developing T2DM and the possibility of intervention to reduce this risk.

CHAPTER 2: METHODS

2.1 Study design

This is a descriptive cross-sectional study carried out in two primary care clinics in Selangor, Malaysia. Data were collected between July - August 2016.

2.2 Study population

The participants recruited for this study were T2DM patients attending the Non-Communicable Diseases (NCD) Unit at Klinik Kesihatan Sungai Buloh (KKSB) and the Primary Care Specialist Clinic (PCSC) in Universiti Teknologi MARA (UiTM) Selayang Campus. Written informed consent was obtained from all the participants who took part in this study. Participants were excluded if they have T1DM, did not have at least one child without T2DM, were pregnant or have gestational diabetes, have previous or current history of mental disorders, have visual impairment or did not understand Malay language.

2.3 Setting

KKSB was selected as it is located in a semi urban area and is a Type 3 facility serving up to 300-500 patients a day. KKSB has an NCD unit that runs on a daily basis providing a good pool of patients as a sampling frame for this study. The PCSC was selected as it is located within the Faculty of Medicine, UiTM Selayang Campus, which officially opened in 2010 and is equipped with outpatient clinics and research facilities. It also provides a good pool of patients with T2DM as a sampling frame for this study.

2.4 Questionnaire

The Diabetes Mellitus in the Offspring Questionnaire (DMOQ) is a short, self-administered questionnaire, originally developed in 2009 by Whitford et. al. based on the parameters of

the Health Belief Model. It was recently adapted, translated and validated in the Malay language. The DMOQ Malay version used in this study comprised of 22 items framed within five concepts: 1) knowledge of risk factors and risk reduction of developing T2DM, 2) perceived susceptibility, 3) perceived benefits, 4) perceived barriers and 5) perceived severity. The DMOQ Malay version is a valid and reliable research tool which can be used to evaluate the perception of patients with T2DM concerning perceived risk of their offspring in developing T2DM and the possibility of prevention of T2DM.

2.5 Procedures for data collection

A research assistant was trained to approach and interview T2DM patients attending the NCD Clinic at KKSB and PCSC. Patients were screened via face-to-face interview to ensure they meet both the inclusion and exclusion criteria. Potential patients deemed eligible were invited to partake in the study and were given the patient information sheet about the study in the Malay language and a copy of the DMOQ Malay version. Patients who were willing to participate were requested to sign a consent form. Each participant was requested to provide demographic data including age, gender, ethnicity, family history of T2DM, the duration diagnosed with T2DM, current treatment for T2DM, personal status and the highest formal education attainment. Upon completion, the questionnaire and patient information sheet were returned to the research assistant on the same day.

2.6 Statistical analysis

Data were entered and analysed using the SPSS version 22.0. The distribution of responses for categorical variables was presented in the form of frequency and percentages. Responses for numerical variables were presented in the form of mean and standard deviation.

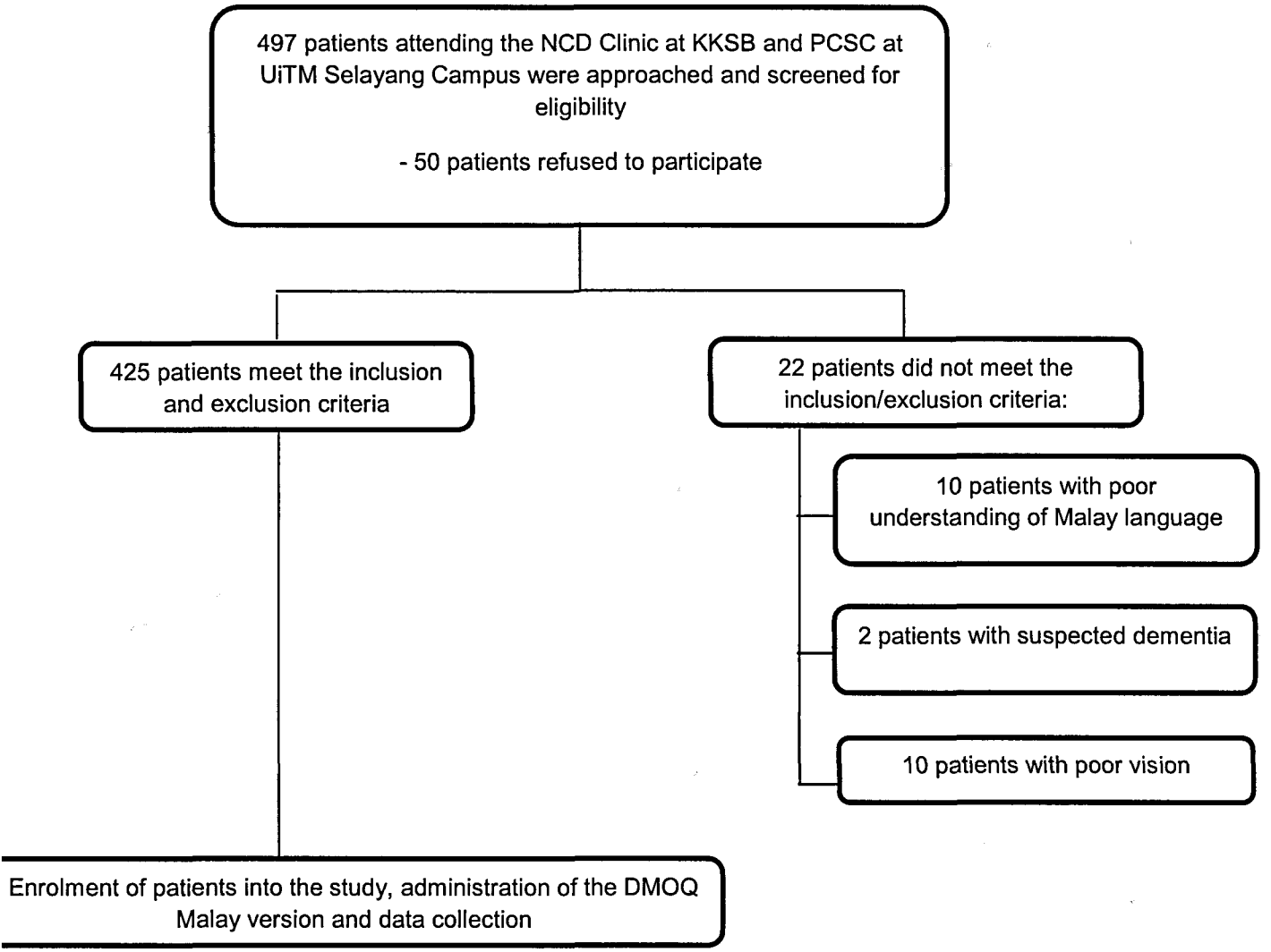

Figure 1: Patient's inclusion in the study and response rate

2.7 Ethical approval

Ethical approval was obtained from the NMRR and Ethics committee of UiTM to conduct the study.

CHAPTER 3: RESULTS

A total of 425 participants were recruited into the study out of 497 patients who were approached (50 refused to participate and 22 patients did not meet the inclusion/exclusion criteria. Table 1 shows the socio-demographic characteristics of the respondents. The mean age was 55 years old, 48.9% were males and 51.1% were females. Majority (87.8%) of the respondents were Malays. The mean duration of T2DM since diagnosis was 7 years and majority (63.1%) of the respondents were on oral anti-diabetic agents for treatment. Majority (76%) of the respondents had a family history of T2DM and majority (60.2%, 95%CI: 55.6, 64.9) were willing to accept 'training to speak to their offspring about risk of T2DM if given a chance.

Table 1: Demographic characteristics

	Willing to accept training		
	n (%)	n (%)	n (%)
Overall	**Yes 256 (60.2%)**	**No 169 (39.8%)**	**Total 425 (100%)**
Age:			
[Mean (SD)]	54.33 (8.39)	56.05 (8.76)	54.99 (8.57)
Gender:			
Male	131 (50.0)	77 (47.2)	208 (48.9)
Female	131 (50.0)	86 (52.8)	217 (51.1)
Ethnicity:			
Malay	230 (87.8)	143 (87.7)	373 (87.8)
Chinese	8 (3.1)	8 (4.9)	16 (3.8)
Indian	17 (6.5)	9 (5.5)	26 (6.1)
Bumi (Sabah& Sarawak)	3 (1.1)	1 (0.6)	4 (0.9)
Others	4 (1.5)	2 (1.2)	6 (1.4)
Marital Status:			
Married	234 (89.3)	137 (84.0)	371 (87.8)
Widowed	23 (8.8)	22 (12.5)	45 (10.6)
Divorce	4 (1.5)	3 (1.8)	7 (1.6)
Not Married	1 (0.6)	1 (0.6)	2 (0.5)
Education:			
No	5 (1.9)	5 (3.1)	10 (2.4)
Primary	35 (13.4)	29 (17.8)	64 (15.1)
Secondary	145 (55.3)	90 (55.2)	235 (55.3)
Tertiary	77 (29.4)	39 (23.9)	116 (27.3)
Duration of T2DM (month):			
[Mean (SD)]	7.32 (5.91)	8.05 (6.95)	7.60 (6.33)

Treatment:			
Diet only	9 (3.4)	6 (3.7)	15 (3.5)
Oral anti-diabetic agent only	165 (63.0)	103 (63.2)	268 (63.1)
insulin only	14 (5.3)	13 (8.0)	27 (6.4)
Oral anti-diabetic agent and insulin	74 (28.2)	41 (25.2)	115 (27.1)
Family history of T2DM:			
Yes	210 (80.2)	113 (69.3)	323 (76.0)
No. of offspring without T2DM:			
[Mean (SD)]	3.64 (1.75)	3.83 (2.02)	3.71 (1.86)

Table 2 shows the association of knowledge of T2DM risk factors among the respondents and their willingness to accept training. Respondents were asked to choose from a list of factors which may contribute to a person's risk of T2DM; 60.2% chose overweight, 59.3% chose lack of exercise and only 44.5% chose age >40 years-old as a risk factor. In addition, 16.9% of the respondents perceived that excessive salt intake as a risk factor for T2DM.

There was a significant association between having knowledge of overweight as a risk factor of T2DM and willingness to accept training (P=0.038). Those who had knowledge of overweight being a risk factor of T2DM were 1.52 times more likely to accept training compared to those who did not know [OR: 1.52 (95%CI: 1.02, 2.67)].

There was a significant association between having knowledge that 'age >40 years old is a risk factor of T2DM' and the willingness to accept training (P=0.012). Those who had the knowledge that 'age >40 is a risk factor of T2DM' were 1.52 times more likely to accept training compared to those who did not know [OR: 1.52 (95%CI: 1.12, 2.48)].

Table 2: Association of knowledge of T2DM risk factors and willingness to accept training

Risk Factor	Willing to accept training n (%) Yes 256 (60.2%)	Willing to accept training n (%) No 169 (39.8%)	n (%) Total 425 (100%)	x^2 (df)	P value
Overweight:					
Yes	168 (64.1)	88 (54.0)	256 (60.2)	4.309	**0.038***
No	94 (35.9)	75 (46.0)	169 (39.8)	(1)	
Excessive salt intake:					
Yes	51 (19.5)	21 (12.9)	72 (16.9)	3.094	0.079
No	211 (80.5)	142 (87.1)	353 (83.1)	(1)	
Lack of exercise:					
Yes	162 (61.8)	90 (55.2)	252 (59.3)	1.823	0.177
No	100 (38.2)	73 (44.8)	173 (40.7)	(1)	
Age >40:					
Yes	129 (49.2)	60 (36.8)	189 (44.5)	6.284	**0.012***
No	133 (50.8)	103 (63.2)	236 (55.5)	(1)	

*** Statistically significant results, P<0.05**

Table 3 shows responses to the question "if you are given a chance to receive training in speaking to your offspring about the risk of T2DM and what can they do to reduce their risk, would you be willing to accept this training?" and the associated factors from the Health Belief Model. With regards to perceive threat (susceptibility of developing T2DM in offspring), there was significant association between willingness of T2DM patients to accept training with the perceived likelihood that their offspring will get T2DM (P=0.034) and worry that their offspring will get T2DM (P=0.006). Majority of the respondents (64.7%) perceived that their offspring were likely to develop T2DM. Out of these respondents, 68.7% were willing to accept training. Majority of the respondents (84.2%) worry that their offspring will get T2DM. Out of these respondents, 87.8% were willing to accept training.

In terms of benefits in reducing the risk of T2DM in their offspring, there were significant associations between willingness of T2DM respondents to accept training with the perceived

benefits of discussing healthy diet and exercise (P=0.034) and encouraging lifestyle changes with their offspring (P<0.001).

Regarding barriers in reducing the risk of T2DM in their offspring, there were significant associations between willingness of T2DM respondents to accept training with challenges of discussing health risk with their offspring in terms of lack of contact with their offspring (P=0.012) and offspring were not open to their advice (P=0.002).

With regards to perceived threat (severity) in those who were willing to accept training, there was a significant association between perceived severity of diabetes compared to AIDS [OR: 0.32 (95%CI: 0.12, 0.81)]. Respondents were more likely to perceive T2DM as relatively less serious (severe) compared to AIDS. For those who were not willing to accept training, there was no significant association between perceived severity of diabetes compared to cancer [OR: 1.00 (95%CI: 0.34, 2.92)] or AIDS [OR: 0.41 (95%CI: 0.15, 1.03)].

Table 3: Responses to the question "if you are given a chance to receive training in speaking to your offspring about the risk of T2DM and what can they do to reduce their risk, would you be willing to accept this training?" and the associated factors from the Health Belief Model

	Willing to accept training				
	n (%)	n (%)	n (%)	x^2 (df)	P value
	Yes 256 (60.2%)	No 169 (39.8%)	Total 425 (100%)		
PERCEIVED SUSCEPTIBILITY					
Likelihood that offspring will get diabetes:					
Not likely	43 (16.4)	28 (17.2)	71 (16.7)	6.760	**0.034***
Neutral	39 (14.9)	40 (24.5)	79 (18.6)	(2)	
Likely	180 (68.7)	95 (58.3)	275 (64.7)		
Likelihood someone without family history of T2DM will get T2DM:					
Not likely	33 (12.6)	14 (8.6)	47 (11.1)	5.518	0.063
Neutral	10 (3.8)	14 (8.6)	24 (5.6)	(2)	
Likely	219 (83.6)	135 (82.8)	354 (83.3)		
Worry that offspring will get diabetes:					
Not worry	21 (8.0)	15 (9.2)	36 (8.5)	10.165	**0.006***
Neutral	11 (4.2)	20 (12.3)	31 (7.3)	(2)	
Worry	230 (87.8)	128 (78.5)	358 (84.2)		
BENEFIT ANALYSIS					
Talking make offspring more aware of importance of diet and exercise:					
Agree	257 (98.1)	152 (93.3)	409 (96.2)	6.535	**0.038***
Neutral	2 (0.8)	5 (3.1)	7 (1.6)	(2)	
Disagree	3 (1.1)	6 (3.7)	9 (2.1)		
Encourage offspring to make lifestyle changes:					
Agree	257 (98.1)	145 (89.0)	402 (94.6)	16.652	**<0.001***
Neutral	2 (0.8)	10 (6.1)	12 (2.8)	(2)	
Disagree	3 (1.1)	8 (4.9)	11 (2.6)		
Help prevent T2DM:					
Agree	251 (95.8)	148 (90.8)	399 (93.9)	5.589	0.061
Neutral	6 (2.3)	5 (3.1)	11 (2.6)	(2)	
Disagree	5 (1.9)	10 (6.1)	15 (3.5)		
BARRIER					
I do not have a healty lifestyle myself:					
Agree	121 (46.2)	72 (44.2)	193 (45.4)	2.204	0.322
Neutral	33 (12.6)	29 (17.8)	62 (14.6)	(2)	
Disagree	108 (41.2)	62 (38.0)	170 (40.0)		
I do not have much					

contact with my offspring:					
Agree	204 (77.9)	119 (73.0)	323 (76.0)	12.892	**0.002***
Neutral	13 (5.0)	24 (14.7)	37 (8.7)	(2)	
Disagree	45 (17.2)	20 (12.3)	65 (15.3)		
My offspring are not open to advice from me:					
Agree	172 (65.6)	92 (56.4)	264 (62.1)	8.843	**0.012***
Neutral	36 (13.7)	41 (25.2)	77 (18.1)	(2)	
Disagree	54 (20.6)	30 (18.4)	84 (19.8)		
They do not see T2DM as a serious illness:					
Agree	158 (60.3)	97 (59.5)	255 (60.0)	0.844	0.656
Neutral	25 (9.5)	20 (12.3)	25 (9.5)	(2)	
Disagree	79 (30.2)	46 (28.2)	79 (30.2)		
They do not believe they are at risk for T2DM:					
Agree	145 (55.3)	83 (50.9)	228 (53.6)	3.496	0.174
Neutral	42 (16.0)	38 (23.3)	80 (18.8)	(2)	
Disagree	75 (28.6)	42 (25.8)	117 (27.5)		
I prioritize other things than my own health:					
Agree	197 (75.2)	120 (73.6)	317 (74.6)	0.132	0.936
Neutral	24 (9.2)	16 (9.8)	40 (9.4)	(2)	
Disagree	41 (15.6)	27 (16.6)	68 (16.0)		
PERCEIVED SEVERITY OF T2DM					
- Compared to Cancer	0.66 (0.23,1.88)	1.00 (0.34, 2.92)	425	t=0.81; 423 df; p=0.075	
- Compared with AIDS	0.32 (0.12, 0.81)	0.41 (0.15, 1.03)	425	t=1.22; 423 df; p=0.154	

*** Statistically significant results, P<0.05**

Table 4 shows the factors associated with willingness of T2DM respondents to accept training to speak to their offspring regarding risk of T2DM and means of prevention. Two variables emerged from the simple logistic regression analysis. Family history of T2DM (P=0.012) and age (P=0.045) were found to have significant association with willingness of T2DM respondents to accept training. However, in the multiple logistic regression analysis, the only significant associated factor was family history of T2DM (P=0.012). Those who have a family history of T2DM were 1.79 times more likely to accept training compared to those who did not have family history of T2DM [OR: 1.79 (95%CI: 1.14, 2.80)].

Table 4: Factors associated with willingness of T2DM respondents to accept training to speak to their offspring regarding risk of T2DM and means of prevention

Variables	Simple Logistic Regression (LogR)			Multiple Logistics Regression (MLogR)			
	Beta (SE)	P value	OR (95%CI)	Adj. Beta (SE)	Wald (df)	P value	Adj. OR (95%CI)
Duration of T2DM	-0.02 (0.02)	0.247	0.98 (0.95, 1.01)	-	-	-	-
Treatment:				-	-	-	-
Diet only		0.693	1				
Oral antidiabetic agent only	0.07 (0.54)	0.903	1.07 (0.37, 3.09)				
insulin only	-0.33 (0.65)	0.612	0.72 (0.20, 2.58)				
Oral antidiabetic agent and insulin	0.19 (0.56)	0.741	1.20 (0.40, 3.62)				
FHx of T2DM (Yes vs. No)	0.58 (0.23)	0.012*	1.79 (1.14, 2.80)	0.58 (0.23)	6.377 (1)	0.012*	1.79 (1.14, 2.80)
No. of offspring without T2DM	-0.06 (0.05)	0.303	0.95 (0.85, 1.05)	-	-	-	-
Gender (Male vs. Female)	-0.11 (0.20)	0.580	0.90 (0.61, 1.32)	-	-	-	-
Age	-0.02 (0.01)	0.045*	0.98 (0.05, 0.99)	-	-	-	-
Ethnicity:							
Malay	-0.22 (0.87)	0.803	0.80 (0.15, 4.45)	-	-	-	-
Chinese	-0.70 (1.00)	0.488	0.50 (007, 3.55)				
Indian	-0.06 (0.96)	0.952	0.94 (0.14, 6.19)				
Bumi (Sabah & Sarawak)	0.41 (1.44)	0.779	1.50 (0.09, 25.59)				
Others		0.842	1				
Marital Status:							
Married		0.463	1	-	-	-	-
Widowed	-0.49 (0.32)	0.122	0.61 (0.33, 1.14)				
Divorce	-0.25 (0.77)	0.748	0.78 (0.17, 3.54)				
Not Married	-0.54 (1.42)	0.706	0.59 (0.04, 9.44)				
Education:							
No		0.398	1	-	-	-	-
Primary	1.89 (0.68)	0.782	1.21 (0.32, 4.58)				
Secondary	0.78 (0.65)	0.461	1.61 (0.45, 5.72)				
Tertiary	0.68 (0.66)	0.304	1.97 (0.54, 7.23)				

Notes:
* Statistically significant at α=0.05
CI=confidence interval; df = degree of freedom; OR: odds ratio
P value = p values from Wald's tests
Hosmer and Lemeshow test =0.560
Multiple logistic regression (no multicollinearity).
All assumptions were met.

CHAPTER 4: DISCUSSION

4.1 Main findings of the study in comparison with previous literature

This is the first study in Malaysia which evaluated the perception of T2DM patients on the risk of their offspring in developing T2DM and the possibility of intervention to reduce this risk. Our study shows that majority of T2DM patients were willing to accept training to speak to their offspring about risk and preventive strategies of T2DM if given the chance. In comparison to a similar study in the Irish population (18), our study showed a higher proportion of patients (60.2%) who were willing to accept training compared to the Irish (56%). Our study found that the respondents who were willing to accept training were those with higher perceived risk of their offspring developing T2DM, and this finding is similar to the Irish study (18) and the Arab-Americans study (17).

This study shows that 76% of the respondents have a family history of T2DM and out of these, 80.2% were willing to accept training to speak to their offspring. Similar to a previous study, this study found respondents with an existing family history of T2DM were more likely to accept training (18).

In addition, this study shows an increase in awareness and perception among T2DM respondents on the risk of their offspring developing T2DM compared to previous studies. In this study, 64.7% of the respondents perceived that their offspring were likely to get T2DM. This finding is comparable to the Irish study (62.2%) (18), but higher compared to a UK study (32%) (15) and another study conducted in Japan (40%) (12). Another study comparing the Irish and Bahrain populations found that

62% of the Irish and only 51% of the Bahrain population perceived their offspring to develop T2DM (10).

This study also discovers that there was a much greater anxiety among T2DM Malaysian respondents i.e. 84.2% worry that their offspring would develop T2DM compared to 49% in the UK study (15), 66.9% in the Irish study (18) and 53% among the Bahrain population (10).

In terms of perceived benefits, this study presents parallel findings as previous research (18) (10) with over 90% of T2DM respondents appreciated the benefits of speaking to offspring about the risk and preventive measures of T2DM in which, will improve offspring awareness of the importance of diet and exercise, encourage them to make lifestyle changes and help prevent T2DM.

However, this study reveals greater perceived barriers among T2DM respondents in discussing the risk of T2DM with their offspring compared to the Irish (18) and Bahrain study (10). In this study, 46% of the respondents were concerned regarding the lack of contact with their offspring. Majority of the respondents were also concerned that their offspring were not open to advice (62.1%), did not consider T2DM to be serious (60%) and did not believe that they were at risk (53.6%). Less than half (45.4%) of the respondents reported that their own lifestyle was unhealthy as a perceived barrier, which is lower, compared to 58% in the Irish population (18) and 56% in the Bahrain population (10).

Additionally, this study found that knowledge on T2DM risk factors was generally poor with only 60.2% recognized 'overweight', 59.3% recognized 'lack of exercise' and 44.5% recognized 'age >40 years-old' as risk factors for T2DM. This is comparable to the Irish study (18). However, the Bahrain population generally showed better knowledge of risk factors of T2DM (10). This study shows that 16.9% of the respondents chose 'excessive salt intake' as a risk factor of T2DM. This is much higher compared to the Bahrain study (6%) (10), but lower compared to the Irish study (27%) (18).

4.2 Strength and limitation of the study

The strength of this study includes the utilisation of the DMOQ Malay version which is a valid and reliable research tool to assess the risks perception of T2DM patients. The original DMFQ was designed based on the Health Belief Model, which is a sound theoretical framework.

Limitation of this study includes the convenience sampling method which is vulnerable to sampling bias. The findings may not be representative of T2DM patients in the Malaysian primary care as the study was conducted in two primary care clinics only. It is well recognised that a more representative and unbiased sampling method would be by systematic random sampling of a larger number of primary care clinics in Malaysia and a systematic random sampling T2DM patients. However, random sampling method could not be conducted for this study due to the unavailability of electronic T2DM registry, and also due to the limited time given to complete this project.

4.3 Implications to clinical practice and further research

This study provides vital information to aid health care professionals and policy makers in developing effective training strategies for the T2DM patients to become the 'agent of change' to prevent their offspring from developing T2DM. It is heartening to note that majority of the T2DM patients in this study were willing to accept training so that they could help to prevent T2DM in their offspring. However, poor knowledge of diabetes risk factors among the study population suggests that public healthcare professionals need to find ways to provide better education and help T2DM patients improve their understanding about the disease and its risk factors, which would eventually aid prevention of T2DM in their offspring.

Further research using systematic random sampling of a larger number of public primary care clinics in Malaysia and a larger number of T2DM patients are needed for the findings to be generalised to the T2DM patients in the public primary care setting. Future research should include pragmatic clinical trials to investigate the effectiveness of T2DM patients as the change agent in preventing T2DM in their offspring. Such evidence is required to guide policy change and resource allocations in the Malaysian public primary care setting.

CHAPTER 5: CONCLUSION

In conclusion, this study is the first study in Malaysia which provides vital information to aid health care professionals and policy makers in developing effective training strategies for the T2DM patients to become the 'agent of change' to prevent their offspring from developing T2DM. It utilised the DMOQ Malay version, which is a valid and reliable research tool. Majority of T2DM patients in this study were willing to accept training to speak to their offspring about risk and preventive strategies of T2DM if given the chance. However, poor knowledge of diabetes risk factors among the study population suggests that public healthcare professionals need to find ways to provide better education and help T2DM patients improve their understanding about the disease and its risk factors, which would eventually aid prevention of T2DM in their offspring.

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