

# Are Malaysian T2DM patients willing to be trained to speak to their offspring about risk of diabetes and preventive measures?

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## Research article

**Keywords:** Diabetes mellitus, offspring, risk perception, training, primary care, Malaysia

**Posted Date:** August 3rd, 2019

**DOI:** <https://doi.org/10.21203/rs.2.11507/v1>

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**Version of Record:** A version of this preprint was published at BMC Family Practice on March 11th, 2020. See the published version at <https://doi.org/10.1186/s12875-020-01121-0>.

# Abstract

**Background:** Offspring of Type 2 Diabetes Mellitus (T2DM) patients have an absolute risk of 20-40% of developing the condition. Therefore, T2DM patients should be encouraged to speak to their offspring regarding diabetes risk and prevention strategies. The Health Belief Model (HBM) conceptualises that the higher the perceived risk, the more likely an individual will modify their behaviour. The objectives of this study were to i) determine the distribution of T2DM patients according to their willingness to accept training to speak to their offspring, ii) determine the distribution of T2DM patients according to their willingness to accept training based on the HBM and iii) to determine the factors associated with their willingness to accept training. **Methods:** This was a cross-sectional study amongst T2DM patients attending two primary care clinics in Malaysia. Data on socio-demography and knowledge of diabetes risk factors were collected. The adapted, translated and validated Diabetes Mellitus in the Offspring Questionnaire-Malay version (DMOQ-Malay) was self-administered. Statistical analysis included descriptive statistics, univariate and multiple logistic regression (MLogR). **Results:** A total of 425 participants were recruited. Of these, 61.6% were willing to accept training. In MLogR, six variables were found to be significantly associated with willingness to accept training. These were i) positive family history (Adj. OR 2.06 (95% CI: 1.27, 3.35)), ii) having the correct knowledge that being overweight is a risk factor (Adj. OR 1.49 (95%CI: 1.01, 2.29)), iii) correctly identifying age of more than 40 years old as a risk factor (Adj. OR 1.88 (95%CI: 1.22, 2.90)), iv) agreeing that speaking to their offspring would help them to prevent T2DM (Adj. OR 4.34 (95%: 1.07, 17.73)), v) being neutral with the statement 'I do not have much contact with my offspring' (Adj. OR: 0.31 (95% CI: 0.12, 0.810)) and vi) being neutral with the statement 'my offspring are not open to advice from me' (Adj. OR: 0.63 (95% CI: 0.31, 0.84)). **Conclusion:** The majority of T2DM patients were willing to accept training to speak to their offspring to prevent diabetes. A training module should be designed to enhance their knowledge, attitude and skills to become family health educators.

## Background

Diabetes mellitus is one of the commonest non-communicable diseases (NCD) and the prevalence is rising globally at an alarming rate. The International Diabetes Federation estimates the prevalence of diabetes mellitus will increase from 425 million in 2017 to 629 million by the year 2045 [1]. This equates to around nine million new cases of diabetes mellitus every year. In Malaysia, the overall prevalence of diabetes mellitus among adults of 18 years old was reported at 17.5% according to the latest National Health Morbidity Survey in 2015 [2]. This clearly demonstrates the importance of diabetes prevention, especially in high-risk groups. One of the high-risk groups of interest is offspring of individuals with Type 2 diabetes mellitus (T2DM) [3].

Evidence has shown that offspring who have one parent with T2DM have an absolute risk of 20-40% of developing the condition [4]. Genetic predisposition of an individual is considered an essential factor in the development of T2DM, but the presence of environmental and behavioural factors further play a role in the activation of these genes [5]. Studies have also shown that family members living together have a

predisposition to developing similar diseases as they tend to adopt similar lifestyle behaviours [6]. This demonstrates the pivotal role of lifestyle modification among family members of individuals with T2DM in order to prevent diabetes [7].

A starting point may be to encourage T2DM patients to become the promoter of health within their family by talking to their offspring about risk of diabetes [8]. This would be more effective if they were able to promote preventive lifestyle changes as a means to prevent T2DM in their offspring. However, implementing diabetes prevention strategies and interventions in the family is challenging and less likely to be successful should they not perceive their family members to be at risk of diabetes [9].

Risk perception also known as perceived risk has been extensively studied and forms a central construct of many health behaviour models that addresses health-protective behaviours [10]. The Health Belief Model (HBM) conceptualises that the higher the perceived risk of developing a certain disease, the more likely an individual will modify their behaviour. In the context of diabetes prevention in the offspring, it is hypothesized that T2DM patients who perceive their offspring to be at risk of developing the condition will be more likely to introduce change within their family as a means of prevention.

Hence, establishing the risk perception of T2DM patients who have offspring is important prior to introducing preventive lifestyle intervention within their family. This step is crucial to identify T2DM patients who are willing to motivate and speak to their offspring about adopting risk-reducing behaviour and accept diabetes prevention strategies [11]. Several studies have assessed perceived diabetes risk and the possibility of prevention in the T2DM population and their offspring [12-15]. Other studies have further investigated the willingness of T2DM patients to participate in diabetes prevention strategies [8,12,16].

Whitford et al studied the perceived diabetes risk and the willingness of T2DM patients to speak to their offspring and siblings among the Irish population [8]. They developed a questionnaire in the English language based on the domains of the HBM [17] including knowledge of diabetes risk factors, perceived susceptibility, perceived benefits, perceived barriers and perceived severity. This questionnaire was later named the Diabetes in the Offspring Questionnaire (DMOQ) which was adapted, translated, and validated into the Malay language (DMOQ Malay) [18].

However, to date, perceived diabetes risk among T2DM patients has not been studied in the Malaysian context. This paucity of evidence led to this study which aims to i) determine the distribution of T2DM patients according to their willingness to accept training to speak to their offspring, ii) determine the distribution of T2DM patients according to their willingness to accept training based on the domains of the HBM and iii) to determine the factors associated with T2DM patients' willingness to accept training.

## Methods

### Study design and setting

This was a cross-sectional study carried out in two primary care clinics in the state of Selangor, Malaysia between July to August 2016. One of the clinics was located in a semi urban area while the other clinic was located in an urban area. The two centres provided a good diversity of racial backgrounds of patients.

### Study population

The participants recruited for this study were T2DM patients who were receiving care at the two primary care clinics. The inclusion criteria included T2DM patients who were 18 years old, had at least one offspring without T2DM and were able to speak and understand the Malay language. Patients were excluded if they had Type 1 Diabetes Mellitus, were pregnant, had gestational diabetes, had a previous or current history of mental disorders, had visual impairment that may impede the administration of the study tool or could not speak or understand the Malay language.

### Sampling method

T2DM patients attending the clinics were approached consecutively, given a patient information sheet describing the study and were invited to participate. Patients who agreed were then screened to assess whether they met the inclusion and exclusion criteria. Medical records were also checked for secondary data for confirmation of details. Those who were eligible were recruited into the study and written informed consent was obtained.

### Study tool

The tool that was used in this study was the DMOQ Malay version [18]. This self-administered questionnaire was used to assess the perceptions of T2DM patients towards their offspring's risk of developing T2DM and the possibility of prevention. The English version of this questionnaire was originally developed in 2009 by Whitford et al [8] based on the domains of the HBM which includes perceived susceptibility, perceived benefits, perceived severity and perceived barriers [17]. It was later adapted, translated and validated into the Malay language [18]. The DMOQ Malay version comprised of 21 items framed within five domains: 1) knowledge of T2DM risk factors, 2) perceived susceptibility, 3) perceived benefits, 4) perceived barriers and 5) perceived severity. The Cronbach alpha was 0.714 and the intraclass-correlation coefficient was 0.868 [18].

### Data collection and study procedures

Data was collected by a research assistant (RA) who was trained with regards to the study procedures to minimize variability in the method of data collection. A standardised case report form (CRF) was used to collect socio-demographic information via face-to-face interview of the participants i.e. age, gender, ethnicity, family history of T2DM, number of children without T2DM, personal status and the highest formal education. Data from the medical records of participants were obtained for the purpose of confirming the duration of T2DM and the current treatment for T2DM.

## Administration of questionnaire

Participants were given the DMOQ Malay version with clear instructions on how to fill in the questionnaire. They were asked to circle the options that suited them the most as well as to answer the subjective questions in the space given. Participants were advised to seek for clarification from the RA should any queries arise. They were advised to answer the questionnaires themselves. Most of the participants took approximately 10 to 15 minutes to complete the questionnaire. Once the questionnaire was completed, it was handed to the RA and checked for completeness.

## Sample size calculation

Sample size was calculated using the single proportion formula with 5% precision and 95% confidence interval, where the proportion (P) was estimated based on the findings of a similar study by Whitford et al, which showed that 56% of T2DM patients would speak to family members about their risk of developing diabetes if they were offered training to do so [8]. Therefore, using  $Z = 1.96$ ,  $\Delta$  (precision) =  $\pm 0.05$ ,  $P$  = proportion of willingness to receive training (56%) would give a required sample size of 379. Considering additional 20% of refusal and non-eligibility rate, this study aimed to approach approximately 455 patients.

## Statistical analysis

Data was analysed using the Statistical Package for Social Sciences (SPSS) version 22.0 (IBM). Variables were described as mean  $\pm$  standard deviation ( $\pm$ SD) for continuous data and number (n) and percentage (%) for dichotomous or nominal data. The scores for items 1 to 6 in section 5 of the DMOQ Malay version were reversed as the questions in this section were negatively phrased. The factors associated with willingness of T2DM patients to accept training to speak to offspring were analysed by simple logistic regression (SLogR) followed by multiple logistic regression (MLogR) since the data consisted of categorical variables. The independent variables that were entered into the SLogR were sociodemographic characteristics, knowledge of risk factors of T2DM and items of all the factors of the HBM from the DMOQ. Variables with a  $p$ -value of less than 0.05 by SLogR were then included in the MLogR. A  $p$ -value of less than 0.05 was considered statistically significant in the MLogR.

## Results

Figure 1 shows the flow chart of patient recruitment. A total of 497 T2DM patients were invited to enter the study. Out of this, 50 patients (10.1%) refused to participate. Therefore, 447 patients were screened for eligibility and 22 patients (4.4%) did not fulfil the eligibility criteria. Consequently, 425 patients who met the eligibility criteria were recruited into the study giving a recruitment rate of 85.5%.

PLEASE INSERT FIGURE 1 HERE

Figure 2 shows the distribution of T2DM patients according to their willingness to accept training to speak to their offspring. Out of 425 participants, 61.6% of T2DM patients were willing to accept training .

PLEASE INSERT FIGURE 2 HERE

The demographic characteristics of the participants are shown in Table 1. The proportion of participants with a family history of T2DM who were willing to accept training was higher (80.2%) compared to those who were not willing (69.3%). Otherwise, the demographic characteristics were comparable between those who were willing to accept training and those who were not.

PLEASE INSERT TABLE 1 HERE

Table 2 shows the distribution of T2DM patients according to their willingness to accept training based on the domains of the HBM. For perceived susceptibility, two items were found to have significant trends which were 'likelihood that their offspring is likely to get diabetes' ( $\chi^2 = 6.760$ , 2 d.f.;  $p = 0.034$ ) and 'worry that their offspring will get diabetes' ( $\chi^2 = 11.196$ , 2 d.f.;  $p = 0.004$ ). In the perceived benefits, there were also two items found to have significant trends which were 'talking to their offspring would make them more aware of importance of diet and exercise' ( $\chi^2 = 6.535$ , 2 d.f.;  $p = 0.038$ ) and 'encourage their offspring to make lifestyle changes' ( $\chi^2 = 16.652$ , 2 d.f.;  $p < 0.001$ ). Two items from the domain of perceived barriers were found to show significant trends which were 'I do not have much contact with my offspring' ( $\chi^2 = 12.892$ , 2 d.f.;  $p = 0.002$ ) and 'my offspring are not open to advice from me' ( $\chi^2 = 8.843$ , 2 d.f.;  $p = 0.012$ ). There is no item in perceived severity found to be significant.

PLEASE INSERT TABLE 2 HERE

Table 3 shows the factors associated with willingness of T2DM patients to accept training to speak to their offspring using SLogR and MLogR. Items from the socio-demographic characteristics, knowledge of risk factors and factors of the HBM which were found to be significant in the SLogR were included in the MLogR. The significant variables included into the MLogR analysis were: age group ( $p = 0.025$ ); family history of T2DM ( $p = 0.015$ ); knowledge of T2DM risk factors which were overweight ( $p = 0.038$ ); and age more than 40 years old ( $p = 0.012$ ), 'likelihood that offspring will get diabetes' ( $p = 0.036$ ), 'likelihood someone without family history of T2DM will get T2DM' (neutral vs not likely,  $p = 0.022$ ), 'worry that offspring will get diabetes' ( $p = 0.006$ ), 'encourage offspring to make lifestyle changes' ( $p = 0.002$ ), 'help prevent T2DM' (agree vs disagree,  $p = 0.028$ ), 'I do not have much contact with my offspring' ( $p = 0.003$ ) and 'my offspring are not open to advice from me' ( $p = 0.013$ ).

In MLogR, six variables were found to be significantly associated with willingness of T2DM patients to accept training to speak to their offspring. Those who have a positive family history of T2DM were twice as likely to be willing to accept training compared to those who did not have a family history [Adj. OR 2.06 (95% CI: 1.27, 3.35)]. With regards to knowledge of risk factors, participants who had the correct knowledge that being overweight is a risk factor for T2DM were more likely to be willing to accept training compared to those who did not know [Adj. OR 1.49 (95%CI: 1.01, 2.29)]. Participants who correctly identified age 40 years old as a risk factor for T2DM were more likely to be willing to accept training compared to those who did not [Adj. OR 1.88 (95%CI: 1.22, 2.90)]. For perceived benefits, participants who

agreed that speaking to their offspring would help them to prevent T2DM, were four times more likely to be willing to accept training compared to those who disagreed [Adj. OR 4.34 (95%: 1.07, 17.73)]. With regards to perceived barriers, participants who were neutral with the statements 'I do not have much contact with my offspring' [Adj. OR: 0.31 (95% CI: 0.12, 0.810)] and 'my offspring are not open to advice from me' [Adj. OR: 0.63 (95% CI: 0.31, 0.84)], were more likely to be willing to accept training compared to those who agreed with the negative statements.

PLEASE INSERT TABLE 3 HERE

Figure 3 shows the Receiver Operating Characteristics (ROC) curve for all the significant associated factors for the willingness to accept training. It can be concluded that all six significant variables can discriminate 68.4% (95%CI: 63.2, 73.6%) ( $p < 0.001$ ) for the willingness of T2DM patients to accept training. The sensitivity of this model was 88.9%, however the specificity was only 29.4%.

PLEASE INSERT FIGURE 3 HERE

## Discussion

### Main findings of study and comparison with previous literature

This was the first study in Malaysia determining the distribution of T2DM patients who were willing to accept training to speak to their offspring to prevent diabetes and the factors associated with it. Our study shows that 61.6% were willing to accept training to speak to their offspring, a figure comparable to that (56%) from a previous study in Ireland [8]. A subsequent study conducted by the same group of researchers comparing T2DM patients in Ireland and Bahrain showed that the proportion of patients willing to speak to their family members was significantly higher in Ireland compared to Bahrain (75% vs. 54%,  $p < 0.001$ ) [12]. These findings suggest that T2DM patients in these countries are willing to accept training if offered. This opportunity should be explored further and a training module for T2DM patients should be developed as a potential means of preventing diabetes in their offspring. At present, the evidence on effectiveness of this intervention is lacking. A randomised controlled trial is required to prove its value.

The univariate analysis from our study shows that six items from the domains of the HBM were found to demonstrate significant trends. Some of the items were consistent with the multivariate analysis where six variables were found to be significantly associated with the willingness of T2DM patients to accept training to speak to their offspring. These are i) having a family history of T2DM, ii) correctly identifying that overweight is a diabetes risk factor, iii) correctly identifying age 40 years old as a diabetes risk factor, iv) perceiving the benefit of speaking to offspring to help prevent them from developing diabetes, v) perceiving not having much contact with offspring as a barrier and vi) perceiving their offspring to not being open to advice from them as a barrier.

T2DM patients who have a positive family history were twice as likely to be willing to accept training compared to those who did not have a family history [Adj. OR 2.06 (95% CI: 1.27, 3.35)]. Direct comparison to other studies is not possible as no data was presented in the same manner. Our finding is unique and highlights the importance of targeting those with a strong family history of diabetes in our population in terms of training them to speak to their offspring to prevent diabetes.

With regards to knowledge of risk factors, participants who had the correct knowledge that being overweight [Adj. OR 1.49 (95%CI: 1.01, 2.29)] and age 40 years old [Adj. OR 1.88 (95%CI: 1.22, 2.90)] are risk factors for T2DM were more likely to be willing to accept training compared to those who did not know. Again, direct comparison to other studies is not possible as no data was presented in similar manner. Our study shows that enhancing knowledge of T2DM risk factors among patients would potentially improve their willingness to accept training for diabetes prevention in their offspring.

In terms of perceived susceptibility, our univariate analysis reveals that those who worry and perceived that their offspring were likely to get diabetes showed significant trends in terms of willingness to accept training. However, our multivariate analysis did not reveal that these items were significantly associated with willingness to accept training. Direct comparison with other studies was not possible as no data was presented in a similar presentation. However, Whitford *et. al.* found that Irish T2DM patients who worried about their children developing diabetes were more likely to speak to their family members about their risk of diabetes [OR 4.37 (95% CI: 1.75, 10.92)] [8].

Regarding perceived benefits, patients who agreed that speaking to their offspring would help them to prevent T2DM, were four times more likely to be willing to accept training compared to those who disagreed [Adj. OR 4.34 (95%: 1.07, 17.73)]. This is consistent with the study by Whitford *et. al.* which showed that patients who exhibited an increased appreciation of the benefits of speaking to their offspring were more likely to have engaged in preventive behaviours [8]. Perceived benefit is reflected as the individual's estimate of a likelihood that a given action will achieve a specific goal [17]. However, in the context of preventing diabetes, the challenge would be to educate those who do not appreciate the importance of speaking to their offspring.

In terms of perceived barriers, patients who were neutral with the statements 'I do not have much contact with my offspring' [Adj. OR: 0.31 (95% CI: 0.12, 0.810)] and 'my offspring are not open to advice from me' [Adj. OR: 0.63 (95% CI: 0.31, 0.84)], were more likely to be willing to accept training compared to those who agreed with the negative statements. This is comparable to a study by Becker *et. al.* which found that 'perceived barriers' construct of the HBM to be the most powerful construct across various preventive health study designs and behaviour [17]. However, our findings are unique as patients who were neutral with the statements on communication with their offspring are more likely to be willing to accept training.

Our study therefore suggests that emphasizing HBM parameters when consulting T2DM patients in the clinical setting may lead to an increased willingness to accept training to initiate discussion with their offspring.

## Strengths and limitations of the study

The main strength of this study is the novelty of its findings in demonstrating the willingness of T2DM patients to accept training to speak to their offspring and the factors associated with it. Another strength is the utilisation of the DMOQ Malay version which is a valid and reliable tool to assess the perceptions of T2DM patients towards their offspring's risk of developing T2DM and the possibility of prevention based on the HBM. One of the study limitations was that the DMOQ Malay version could only be administered to participants who were able to read and understand the Malay language. As a result of this, a majority of patients who were included in this study were of the Malay ethnic group. Thus, findings of this study would only be generalisable to the T2DM patients who could read and understand the Malay language. Another limitation was the use of non-probability sampling method which could be vulnerable to sampling bias. However, efforts were made to invite all patients with T2DM in the waiting area of both clinics to participate in this study during the data collection period.

## Implications for clinical practice and future research

Findings from this study suggest that T2DM patients in Malaysia are willing to accept training if offered. A training module should be developed to train T2DM patients to speak to their offspring as a potential means of preventing diabetes. Due to the potential of social influence within families as shown in this study, interventions should be designed with the goals to enhance knowledge, attitude and skills of T2DM patients to become family health educators and model healthy behaviours. It should also facilitate intra-familial communication about risk-reducing behaviours. The module should include i) strengthening knowledge on diabetes risk factors, ii) improving attitude and perception towards the benefit of speaking to offspring to help prevent them from developing diabetes and iii) enhancing communication skills to speak to their offspring. Future research should include a pragmatic randomised controlled trial to evaluate the effectiveness of the training module. There is also a need for further research to explore the views of perceived diabetes risk in the offspring of T2DM patients and their willingness to engage in preventive lifestyle behaviour.

## Conclusions

This study has shown that a majority of T2DM patients were willing to accept training to speak to their offspring to prevent diabetes. A training module should be designed with the goals to enhance knowledge, attitude and skills of these patients to become family health educators and model healthy behaviours. The target group should include those with a positive family history of T2DM. This study should also prompt future research into preventing diabetes among offspring of T2DM patients in Malaysia.

## List Of Abbreviations

NCD = Non-communicable diseases

T2DM = Type 2 Diabetes Mellitus

HBM = Health Belief Model

DMOQ = Diabetes Mellitus in the Offspring Questionnaire

RA = Research assistant

CRF = Case report form

SPSS = Statistical Package for Social Sciences

SD = Standard Deviation

SLogR = Simple logistic regression

MLogR = Multiple logistic regression

Adj OR = Adjusted odds ratio

ROC = Receiver Operating Characteristics

## **Declarations**

Ethics approval and consent to participate

The study protocol and the DMOQ Malay version questionnaire which was used in this study were reviewed and approved by the National Institute of Health and Medical Research Ethics Committee, Ministry of Health Malaysia (NMRR-14-1861-22954) and the University Research Ethics Committee (600-RMI (5/1/6)). Patient information leaflets were distributed in Malay language. Written informed consent was obtained from the participants before they were recruited into the study. Participants were informed that they could withdraw from the study at any time if they wish to do so.

Consent for publication

Participants' consent for publication is not applicable as participants' individual data was neither provided nor presented in the manuscript.

Availability of data and material

Data are kept at the Institute of Pathology, Laboratory and Forensic Medicine (I-PPerForM), Universiti Teknologi MARA (UiTM), Sungai Buloh Campus, Jalan Hospital, 47000 Sungai Buloh, Selangor, Malaysia. Data will be shared upon request and is subjected to the data protection regulations.

Competing interests

The authors declare that they have no conflict of interest.

## Funding

This study was funded by the Ministry of Higher Education (MOHE) Malaysia: *Research Acculturation Grant Scheme (RAGS)* no. 600-RMI/RAGS 5/3 (78/2014)

## Authors' contributions

SFB, ASR, and DLW conceptualised and designed the study. SFB, ASR and MRI acquired the funding and ethics approval. SFB and ASR supervised and coordinated the study. NMZ acquired the data. MRI analysed and interpreted the data. SFB and ASR drafted the manuscript. NMZ, DLW and MRI revised it critically for important intellectual content. All authors have read and given approval for the final manuscript. Each author has participated sufficiently in the work to take public responsibility for appropriate portions of the contents as described. All authors agree to be accountable for all aspects of the work to ensure accuracy or integrity of any part of the work would be appropriately investigated and resolved.

## Acknowledgements

The authors wish to thank the Family Medicine Specialist of Klinik Kesihatan Sungai Buloh (KKSB); Dr. Maimunah Mahmud as well as the nurses and support staff of the NCD Unit of KKSB and Primary Care Specialist Clinic, UiTM Selayang campus who provided facilities and assistance during the data collection.

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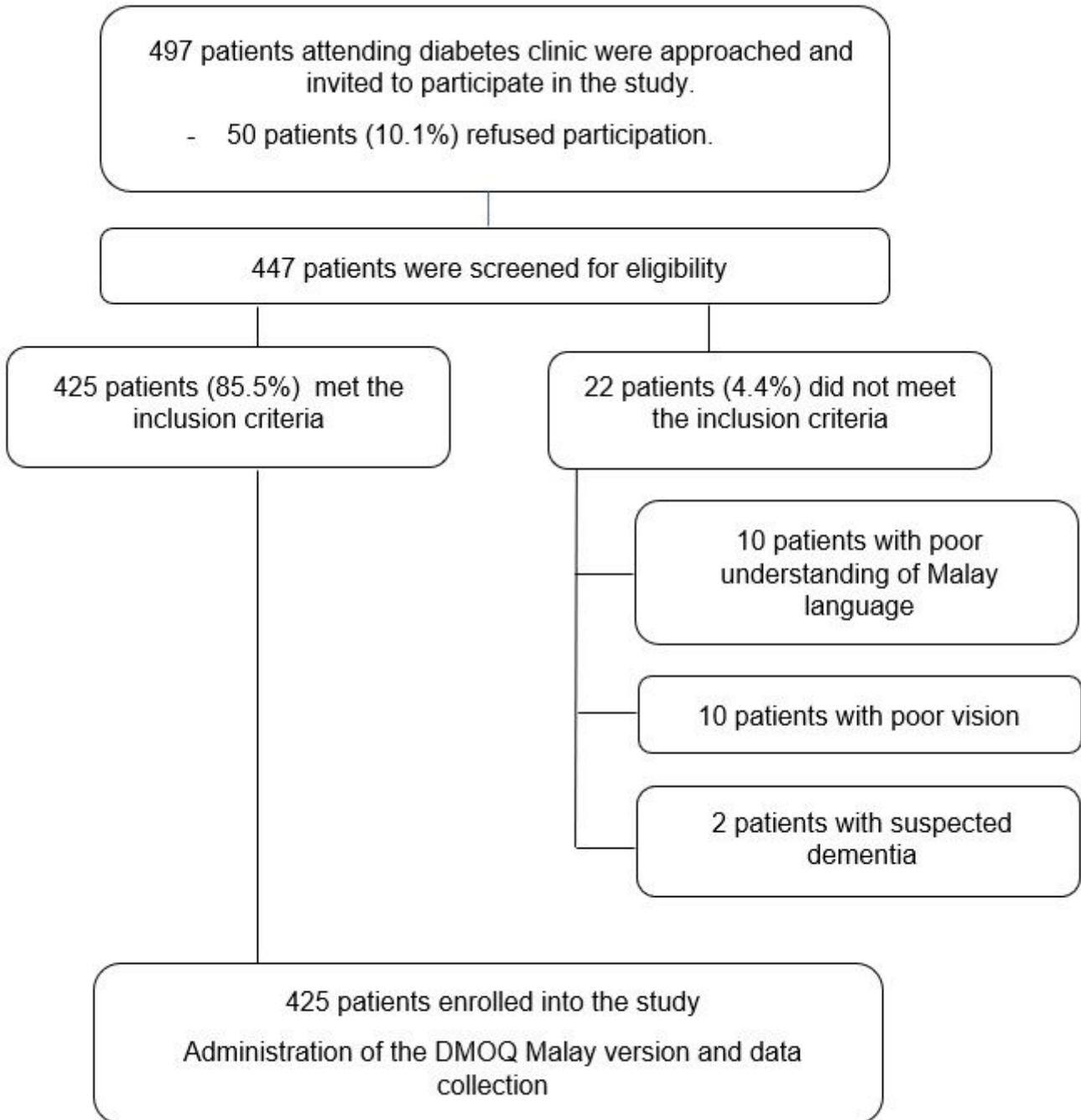
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## Tables

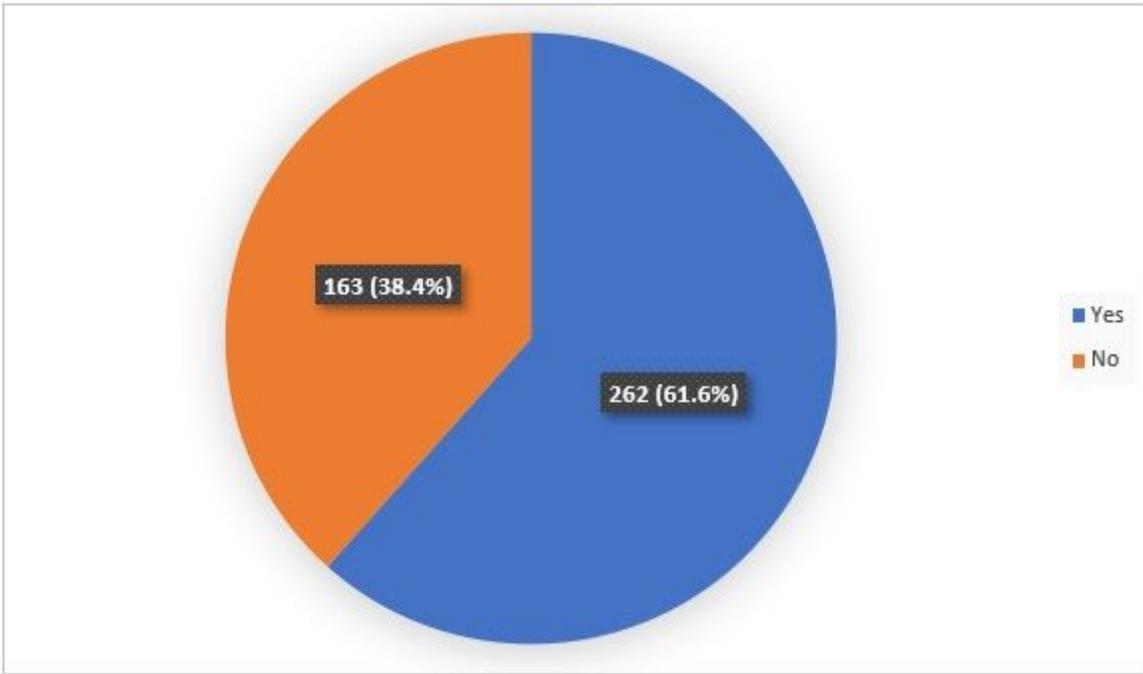
Due to technical limitations, tables 1-3 are only available as downloads in the supplemental file section.

## Figures



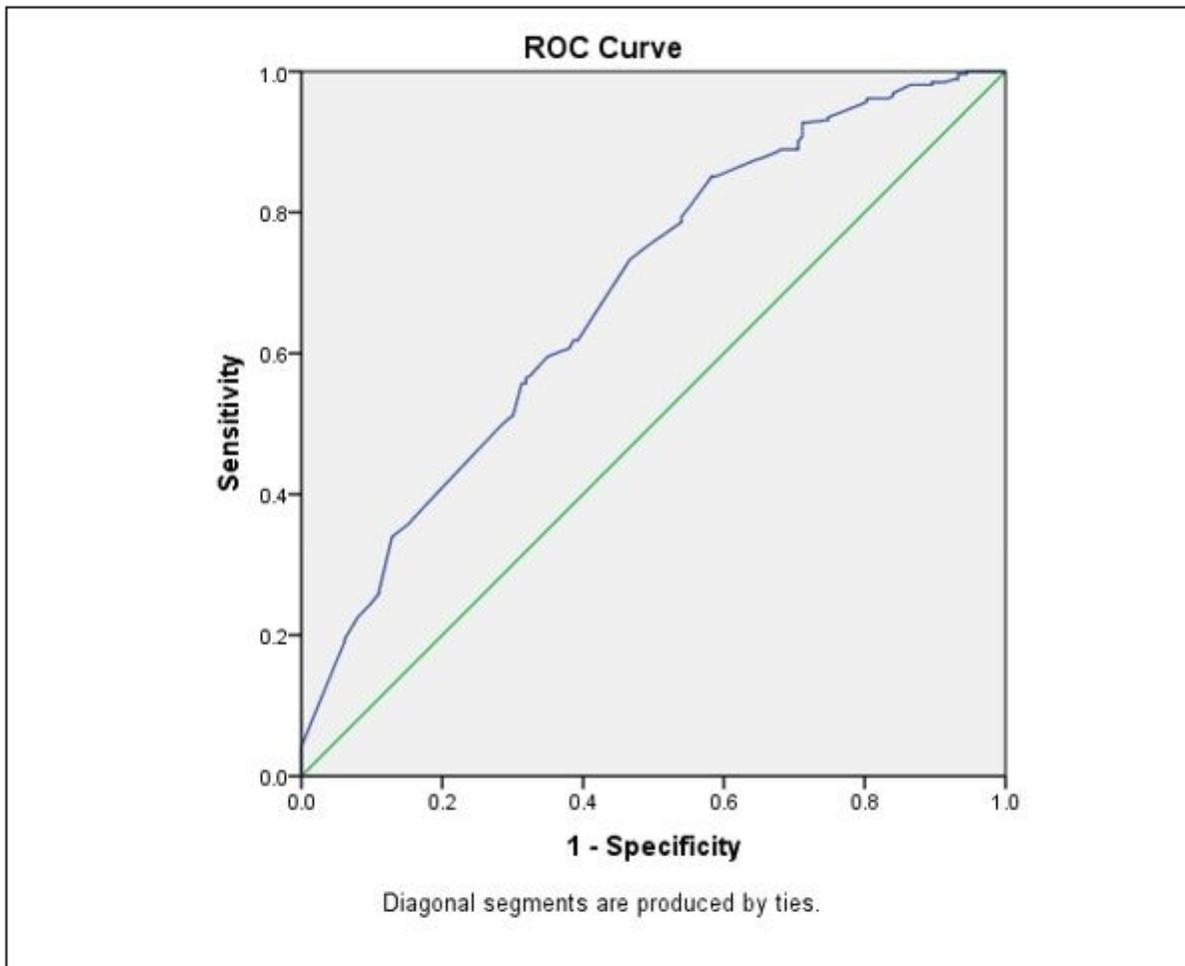
**Figure 1**

Flow chart of patient recruitment



**Figure 2**

Distribution of T2DM patients according to their willingness to accept training to speak to their offspring (N = 425)



**Figure 3**

Receiver Operating Characteristics (ROC) curve of the model developed for the willingness of T2DM patients to accept training.

## Supplementary Files

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- [supplement1.pdf](#)