Menemui Matematik (Discovering Mathematics) 47(3) (2025) 151-160

Menemui Matematik
(Discovering Mathematics)

journal homepage: https://persama.org.my/dismath/home

Assessment of Risk Factors in Developing Diabetes among Public in Malaysia and their Interest for Takaful Products

Sharifah Fairuz Syed Mohamad[1*], Mohd Radzniwan A. Rashid[2], Zurina Kefeli[3a], Nurul Aini Muhamed[3b], Azrul Azlan Iskandar Mirza[4], Junaidah Abu Seman[3c], and Saharuddin Ahmad[5]

[1]*Faculty of Science and Technology, Universiti Sains Islam Malaysia, Negeri Sembilan, Malaysia*
[2]*Faculty of Medicine and Health Science, Universiti Sains Islam Malaysia, Negeri Sembilan, Malaysia*
[3]*Faculty of Economics and Muamalat, Universiti Sains Islam Malaysia, Negeri Sembilan, Malaysia*
[4]*Securities Commission, Malaysia*
[5]*Department of Family Medicine, Faculty of Medicine, Universiti Kebangsaan Malaysia, Selangor, Malaysia*

sh.fairuz@usim.edu.my
*Corresponding author

Received: 15 September 2025
Accepted: 29 November 2025

ABSTRACT

Similar to most other Asian nations, Malaysia is not exempt from the worrisome rise in type 2 diabetes among its people. If left untreated, diabetes' prevalence would lead to an increase in medical and treatment expenditures in addition to its negative physical and psychological impacts. This is especially important for people from low-income households and those without takaful or health insurance. In order to prevent the long-term repercussions of type 2 diabetes, it is crucial that the general population understands the risk factors for getting the disease and the elements that contribute to it. The purpose of this study is to identify and evaluate the risk factors for developing type 2 diabetes. As a result, this study makes an effort to discover and evaluate the risk factors for acquiring type 2 diabetes in Malaysian society before further classifying the risk levels into three groups: low, intermediate, and high. The study also seeks to establish the association between the interest for takaful products associated with type 2 diabetes and two socio-demographic factors; age group and gender. The study used a cross-sectional survey of participants or members of the general public who would be thought to be at risk of getting diabetes in the long run. Descriptive and inferential statistics were used in the analysis, which was conducted using SPSS software. According to the findings, survey respondents are primarily dispersed on the intermediate level, with 46% of them falling into this category, when it comes to risk levels. The percentages are 26.3% and 27.7%, respectively, at low and high levels. This demonstrates that the population of Malaysia may be at intermediate to high risk of getting type 2 diabetes over the long term. Findings from inferential statistics show that there are significant differences across age and gender in the interest of getting takaful products. Therefore, this study would be useful for takaful and insurance companies in targeting consumers for marketing their products, especially those who are at risk of type 2 diabetes.

Keywords: risk factors, type 2 diabetes, health perception, interest for takaful

INTRODUCTION

Diabetes is considered as a chronic medical condition generally characterized through elevated levels of sugar in the blood system. It generally develops when there are problems with insulin; where the insulin hormone regulates glucose level in the body. A person diagnosed with diabetes will have its insulin hormone production to become abnormal and thus is not able to function properly. Generally, diabetes can be categorized into many types but the two common ones are the type 1 and type 2 diabetes. Type 1diabetes is more of an autoimmune condition where the immune system would mistakenly attack insulin producing cells; which results in complete reduction of insulin. Type 2 diabetes on the other hand is developed through gradual decline in the production of insulin where the body loses its function to respond effectively towards insulin. More specifically, type 2 diabetes is associated with different lifestyle habits such as poor diet, lack of exercise and obesity. At the early stages of developing diabetes, various interventions could be done to reduce the effect; such as proper diet, exercise routine, and oral medications. However, later stages may require individuals to depends on insulin.

Worldwide, diabetes is a huge concern with the escalating prevalence in various countries. Although its prevalence varies by region and population, statistics have shown that this disease is still on the rise despite various implementations of campaign and awareness programs. These campaigns and programs are considered efforts to raise awareness of prevalence, symptoms as well as risk factors; other than the available treatments in dealing with diabetes to the public. These initiatives however, could be significant over the long term but needs more enhancement in the way it is being carried out, especially in targeting people who are at risk. In a study by Alzaben et al. (2023), more specific programs were initiated such as including short videos and virtual lectures to enhance awareness among university students in Riyadh, Saudi Arabia. The outcome from such study show that knowledge scores among the students significantly increased after the program while education and awareness are the two factors that actually influence knowledge on type 2 diabetes. Additionally, in a scoping review by Breuing et al. (2021), the programs implemented to raise awareness on this issue needs more appropriate communication strategies and enhancing facilitating factors that help increase public participation and motivation.

According to the World Health Organization (WHO, 2022); about 422 million people worldwide now have diabetes; where majority are those living in low- and middle-income countries. Additionally, it has been reported that 1.5 million deaths are actually connected to diabetes, resulting it to be one of the highest causes of mortality. The disease burden of type 2 diabetes can be seen in different regions in a study by Khan et al. (2017); which shows high prevalence in countries like Netherlands, Switzerland, Sweden, and Taiwan with prevalence values of more than 10,000 per 100,000 population. In the same study by Khan et al. (2017), forecasting method was utilized to predict the outcome of diabetes prevalence in the next few years where their results show the global prevalence cases of 6059 would rise to 7079 by 2030 and 7862 by 2040. Although the prevalence rates are higher in developed regions, the continuation trend of steadily rising prevalence becomes an alarming situation, especially for low- and middle-income countries as they struggle to deal with the escalating costs of diabetes.

The cost of treating diabetes in undeniably increasing over the years and it generally worsens with the concurrent sufferings that may occur such as cardiovascular and kidney diseases; as well as blindness and amputations (Taylor, 2020). Zhou et al. (2022) for example estimated an aggregate annual cost of $57.6 billion in the US for drugs associated with lowering glucose levels. In general, the costs related to this disease will involve the different types including outpatient and inpatient visits, laboratory and medicines. Looking at individual findings which analysed data

based on per-visit costs, Mocheraud et al. (2019) found that on average, the outpatient cost relating to type 2 diabetes ranges from $2.67 to a maximum of $7.41. On the other hand, for inpatient costs, lower-income and lower middle-income countries reported an average of $139; while upper middle-income countries had higher costs averaging $436. Additionally, annual laboratory costs were estimated at $33 per individual on average.

Specifically, in Malaysia, Shafie & Ng (2020) reported estimates of costs in managing the type 2 diabetes complications where these complications include heart diseases, myocardial infarction, heart failures, stroke, renal failure, blindness, foot ulcer and amputation. It was concluded that on the whole, the highest cost catered for macrovascular diseases where myocardial infarction management attributed to an annual cost of $4,528.37. Looking at data for per-patient cost, the end-stage renal disease contributed to the highest cost involving haemodialysis at a cost of $9,905.37 (Shafie & Ng, 2020). In terms of direct outpatient cost per patient, Shafie & Ng (2020) reported higher figures for the Malaysian setting compared to the overall reported by Mocheraud et al. (2019) as the price per person per visit accounts to $8.31 in the year 2016. As a result, these conditions of higher costs to treat and manage diabetes is worrying especially for the low-income group of population.

On the whole, people do feel burdened by the costs of paying the cost of diabetes. Pati et al. (2022) stated that the significant burden for diabetes is especially worsened by the condition of living below the poverty line and less likely to have insurance coverage for such concern. They also reported that in the region of Bhubaneswar, India, the total out-of-pocket expenditure was 2.3 times higher for patients with diabetes and other comorbidities as compared to those with only diabetes. In the US, data reported from the 2000 Behavioral Risk Factor Surveillance System shows that individuals with diabetes either have coverage from private insurance or Medicare (Nelson, et al., 2005). This results in the minority and low-income group who are diagnosed with diabetes to be uninsured and less likely to be treated and gain access to the preventive services. In a later study by Weber & Narayan (2019), it is thus mentioned the undeniable benefits of investing in health insurance prevention as this could effectively reduce the Medicare cost at a later age.

In the recent years, there have been an urge to study the demand for insurance coverage specially tailored for those diagnosed with diabetes due to the complications that follow the onset of the disease to help ease the burden of increasing costs. In a study by Abu Seman et al. (2022), only three insurance companies in Malaysia actually offers protection coverage for those with diabetes while no takaful products have emerged in the market for such cover. It is understandable that coverage specially tailored for such case is usually difficult to sustain especially on the provider side; therefore, it is suggested that plan coverages for diabetes put into a plan for the management instead of solely prevention. This is supported by findings from a study that a large pool of patients who are actually insured but diagnosed of diabetes and large numbers of those who were diagnosed but not receiving needed medication (Dall et al. (2016). These consequences highlight the need to closely monitor and enhance the systems in achieving better diabetes management and care.

From the discussion above, it can be concluded that studies relating to insurance for diabetes are still limited. This paper therefore aims to address some of the gaps that were not highlighted in previous papers, especially those that deal with takaful specifically. The objectives of the paper include:

(i) To identify and assess the risk factors of developing type 2 diabetes among Malaysian public

(ii) To categorize the risk levels into different categories based on the AUDRISK score assessment method
(iii) To analyze the interest for takaful coverage related to diabetes
(iv) To identify whether any significant differences exist between age groups and gender in relation to the interest of opting for takaful products related to diabetes

MATERIALS AND METHODS

Study Design and Sampling

A cross-sectional study was utilized as part of achieving the objectives. Respondents are from the general public who may be considered at risk of having diabetes; although not confirmed or diagnosed. A convenience sampling strategy was used as data collection was done during the period from December 2020 to May 2021; where the Movement Control Order (MCO) occurred as a result from the COVID-19 effects. The survey was distributed online, through google-form across various social media platforms such as whatsapp, telegram and facebook.

The sample size targeted was at least 384 people; following the 95% confidence interval and the 5% margin error which was based on the population of Malaysia, estimating to be around 32 million. The study itself obtained 860 respondents who answered the survey completely.

Instrument and Analysis

The survey questions were developed in dual languages (Malay and English). Information collected includes respondents' socio-demography such as age, income number of children, location of residence, and level of education. Other related questions include those required for measuring risk levels; such as their own perception of health and risk; as well as components that contributed to the risks of developing type 2 diabetes including weight, height, body mass index (BMI), and lifestyle activities like food intake and frequency of exercise. The questionnaire was created and developed based on literature and expert's opinion including from family medicine specialists, endocrinologists, scholars in the field of economics and insurance / takaful as well as industry experts working in insurance organizations. Additionally, the questions went through a validation process by face validity to enhance and improve respondents' understandability.

The analysis carried out in this study are based on the objectives. The first and second objectives require information on measuring and categorizing the respondents to three main groups, namely high, intermediate and low risk levels. This process was done through descriptive analysis of the individual responses and adoption of the AUDRISK model to classify them into the three groups. The AUDRISK model is a general assessment model specifically to measure the risk levels of developing diabetes in the next five years; with a range of scores for each category. The third objective also used descriptive statistics to understand the general level of interest in getting takaful products related to diabetes and its complications; while the final objective utilizes this information together with the socio-demographic factors to identify significant difference between age and gender groups through inferential statistics. The Chi-Square test is further utilized to see whether any differences exist between the groups (age and gender) in relation to the interest to get a takaful product related to diabetes.

The analysis in this study are carried out using the SPSS software.

RESULTS AND DISCUSSION

Respondents Socio-demographic Background

The study respondents totalling 860 people from the public consists of majority of Malay and Muslims; possibly due to the questions on takaful specifically. In terms of gender, more than half are female (63.3%); while with regards to age, majority are in the 21-25 years old group (40%). Furthermore, in terms of education level, respondents are mostly from the degree holder and above; however, their income levels are mostly from the B40 group (70%). Table 1 shows the basic descriptive statistics' findings for socio-demographic variables in the study.

Table 1: Respondents' Socio-Demographic Background

Item	Category	Frequency (n)	Percentage (%)
Age Group	Below 20–year-old	17	2.0
	21 – 25-year-old	352	40.9
	26 – 30-year-old	156	18.1
	31 – 35-year-old	57	6.6
	36 – 40-year-old	61	7.1
	41 – 45-year-old	37	4.3
	46 – 50-year-old	73	8.5
	51 – 55-year-old	50	5.8
	56 – 60-year-old	36	4.2
	61 – 65-year-old	9	1.0
	66 – 70-year-old	4	0.5
	71 – 75-year-old	4	0.5
	75 and above	4	0.5
Gender	Male	316	36.7
	Female	544	63.3
Ethnic	Malay	724	84.2
	Chinese	8	0.9
	India	4	0.5
	Sabah Native	84	9.8
	Sarawak Native	10	1.2
	Others	30	3.5
Religion	Muslim	844	98.1
	Buddhist	4	0.5
	Christian	10	1.2
	Others	2	0.2
Marital Status	Single	485	56.4
	Married	356	41.4
	Divorce	12	1.4
	Widow/Widower	7	0.8
Education Level	No formal education	5	0.6
	Primary school	12	1.4
	Secondary school	111	12.9

	Diploma/Certificate	159	18.5
	Degree & above	573	66.6
Monthly Household Income	RM0.00 – RM4,849	587	68.3
	RM4,850 – RM10,959	184	21.4
	RM10,960 and above	89	10.3

Risk Factors Assessment

The risk factors considered in this study which were based on the AUDRISK scoring assessment method include the age, ethnicity, existing family members with diabetes, body mass index (BMI), active lifestyle, frequency of eating fruits and vegetables, experience having high blood glucose and blood pressure, current smoking behaviour as well as waist measurement.

From the results, the BMI levels of respondents are mostly in the 'overweight' and 'obese' category where the two make up almost half (49.8%). This means that respondents may be considered in the higher risk category of developing diabetes. In terms of lifestyle, half of the respondents maintain at least a 2.5 hour per week of physical activity (50.1%) while a little more than half actually eat fruits and vegetables everyday (61.4%). In essence, this indirectly show that people try to practice an active and healthy lifestyle which is much encouraged in order to curb the increasing numbers of diabetes overall. By using the AUDRISK model, the information discussed above are assessed in terms of scores and then categorized into the different levels of risk. Specific in answering the first and second objectives, Table 2 summarizes this information.

Table 2: Categories of Risk among Respondents according to AUDRISK Model

Risk Category	Frequency (n)	Percentage (%)
Low Risk	226	26.3
Intermediate Risk	396	46.0
High Risk	238	27.7
Total	860	100.0

From Table 2, it can be seen that most of the respondents fall into the intermediate risk where a total of 46% of the 860 people are in this group. Although they are in this category, there are possibilities that they may fall under the high-risk level in the future. Therefore, consistent with the campaigns and awareness programs that have been done to educate the public, those who fall into the low and intermediate level needs to be more concerned about their health. More importantly, hose who fall under the high-risk level, at 27.7% are also much encouraged to be more aware and participate in active lifestyle as well as practice a good and healthy diet to reduce the probability of developing diabetes. Additionally, the concept of insuring health with takaful products related should also be discussed hand in hand when executing such programs. This would hopefully initiate interest in products related and at the same time enhance the public's eagerness to maintain their health.

In answering the third objective of this study, a descriptive analysis showing the interest of respondents to get products related to diabetes are shown in Table 3.

Table 3: Respondents' Interest to get Takaful Product Related to Diabetes (Overall)

Interest to get Product	Frequency (n)	Percentage (%)
Yes	522	60.7
No	96	11.2
Not Sure	242	28.1
Total	860	100.0

Table 4: Respondents' Interest to get Takaful Product Related to Diabetes across Age

Item	Category	Yes	No	Unsure
Age Group	Below 20–year-old	13	3	0
	21 – 25-year-old	215	30	107
	26 – 30-year-old	95	17	44
	31 – 35-year-old	40	4	14
	36 – 40-year-old	46	3	12
	41 – 45-year-old	22	2	13
	46 – 50-year-old	40	13	20
	51 – 55-year-old	27	8	15
	56 – 60-year-old	16	8	12
	61 – 65-year-old	4	2	3
	66 – 70-year-old	2	1	1
	71 – 75-year-old	1	3	0
	75 and above	1	2	1

Table 5: Respondents' Interest to get Takaful Product Related to Diabetes across Gender

Item	Category	Yes	No	Unsure
Gender	Male	219	30	67
	Female	303	66	175
	Total	522	96	242

Table 3 portrays the interest of public to get insurance / takaful product related to diabetes. More than half of the total respondents (60.7%) are actually interested while an 11.2% are not. Another portion of the respondents are still unsure of whether they would want to get related products (28.1%). This undecided situation could be related to the fact that respondents fall under the B40 income group. So, although they are keen on getting coverage for diabetes care, they are not sure if they have the financial capacity to pay for the products. However, this information; especially that more than half are interested; could be used by insurance and takaful companies to address issues of penetration in the country. Table 4 and Table 5 provides a more detailed overview of the interest to get takaful with reference to age group and gender.

Finally, the inferential statistics is used to discover the existence of any significant differences in the interest of purchasing takaful or insurance related to diabetes with regards to age and gender. Table 6 and Table 7 shows the result of Chi Square Pearson Correlation.

Table 6: Chi Square Test for Age Group

Item	Category	p-value
Age Group	Below 20–year-old	<0.001
	21 – 25-year-old	
	26 – 30-year-old	
	31 – 35-year-old	
	36 – 40-year-old	
	41 – 45-year-old	
	46 – 50-year-old	
	51 – 55-year-old	
	56 – 60-year-old	
	61 – 65-year-old	
	66 – 70-year-old	
	71 – 75-year-old	
	75 and above	

Table 7: Chi Square Test for Gender

Item	Category	Yes	No	Unsure	p-value
Gender	Male	219	30	67	<0.001
	Female	303	66	175	
	Total	522	96	242	

From the p-values related to the cross tabulation between age group and interest; and between gender and interest, it can be seen from Table 6 and Table 7 that there is significant differences between the two attributes; age group and gender. This means that the different age groups do respond differently in terms of their interest towards getting diabetes takaful product. Similarly, male and female also respond differently in getting such product. In terms of age, it can be seen clearly that the majority of respondents are from the 21-25-year-old category and may be the contributing factor towards the significance discussed. While for gender, females show a higher interest towards the product in general as compared to males.

Based on the overall objectives and results seen from the analysis of this paper, the following discussion will be provided relevant comparisons with findings from other studies. With regards to the risk categories for people at risk of diabetes, findings such as from Martin, Neale & Tapsell (2018) show that the high-risk category consisted of 51% of the respondents in their study focusing on a region in Australia, as compared to the 27% in the findings of this paper focusing on Malaysia. While in another study by Fleming et al. (2021), an alarming 80% of the respondents in the region of Hunter New England, Australia actually fall under the high-risk category. Additionally, Fleming et al. (2021) based their findings on regrouping the high-risk category to three categories; namely high (a score of 12-15); high (16-19) and high (20+). Nevertheless, the total high-risk level (score of 12 and above) constitutes the 80% which is quite worrying.

With respect to the interest of public in getting coverage for diabetes, Nelson et al. (2005) had already researched the association between health insurance coverage and diabetes care. Findings from Nelson et al. (2005) show that even almost twenty years ago in the US; most respondents in their survey with diabetes are covered by private insurance. However, the product coverage at the time, did not focus on the care for diabetes. On the other hand, a recent study focusing on respondents from Malaysia, an estimated 76% of respondents who were diagnosed with diabetes

were actually uninsured and this was partly due to most respondents having low income of less than RM5,000 (El-Sanaani et al. (2022). In essence, Malaysia's underinsured individuals are still a concern regardless of being diagnosed as having diabetes or possibly at risk. The escalating costs to maintain health should be the starting point to which people actually realize the importance of purchasing insurance or takaful protection. Nevertheless, the income constraint continues to be a battle for many Malaysians who actually desire to have some protection but unfortunately cannot afford to have one. Thus, insurance and takaful companies should scrutinize on offering the low income group with more suitable protection such as collaborating with various organizations in enhancing the management of diabetes in the country.

Future studies could definitely look into more specific components that drive the interest to purchase takaful or insurance related to diabetes, other than the income factor. Qualititative studies could also be done by including interviews from experts from related organizations such as National Diabetes Institute (NADI) to gain more insights on how collaboration could be done between both sectors to enhance the awareness on this matter.

CONCLUSION

The study focused on categorizing the risk levels of diabetes concentrating on the people who may be at risk; where the survey was distributed to the general public in Malaysia. It was found that majority of the respondents are in the intermediate or moderate level of risk. Nevertheless, it should still be a concern since one third of the respondents are considered as high risk. With respect to the age and gender categories and analysing their interest to have an insurance or takaful product related to diabetes, the 21-25 age group and females are more likely to be interested as compared to other ages and males. This can be used as reference for the providing companies to try and increase the penetration rates. However, the main concern still remains in that regardless of their willingness and desire to get coverage, it does hugely depend on the level of income; as they need to put in full commitment for the long term health protection.

ACKNOWLEDGEMENT

We would like to thank FWD Takaful for the funding provided under this consultation project from 1st September 2020 to 30th May 2021.

REFERENCES

Alzaben, A.S., Bakry, H.M., Noha I., Alnashwan, A. A. Alatr, N. A. Alneghamshi, A. A., Norah, A. and Nahla M. B. (2023), The influence of a diabetes awareness program on diabetes knowledge, risk perception, and practices among university students, Primary Care Diabetes, **17(4)**: 327-333

Abu Seman, J., Kamarubaharin, A.F., Iskandar Mirza, A.A., Muhamed, N.A., Kefeli@Zulkefli, Z., Rashid, M.R.A., Syed Mohamad, S.F. and Ahmad, S. (2022), Recent Insurance and Takaful Coverage for Diabetics in Malaysia: A Review, Journal of Contemporary Issues in Business and Government **28(1)**: 2022.

Al-Sanaani E.A., Ismail A., Abdul Manaf M.R., Suddin L.S., Mustafa N., Sukor N., Alabed, A. A. A, Alkhodary A. A. and Aljunid S. M. (2022), Health insurance status and its

determinants among patients with type 2 diabetes mellitus in a tertiary teaching hospital in Malaysia. PLoS One., **17(5)**: e0267897.

Breuing, J., Joisten, C., Neuhaus, A.L., Heß S, Kusche, L., Haas F, Spiller, M. and Pieper, D. (2021) Communication strategies in the prevention of type 2 diabetes and gestational diabetes in vulnerable groups: a scoping review. Syst Rev. ;**10(1)**:301.

Dall T.M., Yang, W., Halder, P., Franz, J., Byrne, E., Semilla, A.P., Chakrabarti, R. and Stuart, B. (2016), Type 2 diabetes detection and management among insured adults. Popul Health Metr. **14**:43.

Moucheraud, C., Lenz, C., Latkovic, M. and Wirtz, V.J. (2019), The costs of diabetes treatment in low- and middle-income countries: a systematic review. BMJ Glob Health. 27; **4(1)**: e001258

Nelson, K.M., Chapko, M.K., Reiber, G. and Boyko, E.J. (2005), The association between health insurance coverage and diabetes care; data from the 2000 Behavioral Risk Factor Surveillance System. Health Serv Res. **40(2)**: 361-72.

Shafie, A.A. and Ng, C.H. (2020) Estimating the costs of managing complications of type 2 diabetes mellitus in Malaysia, Malaysian Journal of Pharmaceutical Sciences, **18(2)**: 15–32,

Khan MAB, Hashim MJ, King JK, Govender RD, Mustafa H, Al Kaabi J. Epidemiology of Type 2 Diabetes - Global Burden of Disease and Forecasted Trends. J Epidemiol Glob Health. 2020 Mar; **10(1)**:107-111.

Taylor, S.I. (220), The High Cost of Diabetes Drugs: Disparate Impact on the Most Vulnerable Patients. Diabetes Care. **43(10)**: 2330-2332

Pati S., Swain S., van den Akker M., Schellevis F. G., Pati S and Burgers J.S. (2022), Health care utilization and out-of-pocket expenditure of type 2 diabetic patients: A study in primary care in Bhubaneswar, India. J Family Med Prim Care. **11(11)**: 6714-6725.

Weber, M.B. and Narayan, K.M.V. (2019) Health Insurance for Diabetes Prevention Confers Health Benefits and Breaks Even on Cost Within 2 Years. Diabetes Care. **42(9)**: 1612-1614.

World Health Organization (WHO), 2022

Zhou, X., Shrestha, S.R., Shao, H. and Zhang, P. (2020), Factors contributing to the rising national cost of glucose-lowering medicines for diabetes during 2005–2007 and 2015–2017. *Diabetes Care;* **43**: 2396–2402