ORIGINAL ARTICLE

Risk Factors of Insulin Refusal Among Type 2 Diabetes Mellitus Patients with Poor Glycaemic Control at Tanglin Health Clinic, Kuala Lumpur

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ABSTRACT

Introduction: The number of patients with poor glycaemic control who refuse insulin therapy is alarming. Factors that contribute to insulin refusal are important to study to identify high risk groups so that appropriate measures can be taken to prevent progression of uncontrolled diabetes. The objective of this study is to determine the risk factors of insulin refusal among type 2 diabetes mellitus patients with poor glycaemic control at Tanglin Health Clinic, Kuala Lumpur, Malaysia. **Methods:** A case control study was conducted among 216 cases and 230 controls using stratified sampling method. Cases were defined as patients with HbA1C more than 7.5% but not on insulin therapy despite being offered by the doctor whereas controls consist of patients with HbA1C of more than 7.5% but already on insulin therapy. Data was collected from April until May 2018, using a self-administered questionnaire. Analysis was done via IBM SPSS version 23.0. **Results:** Response rate for cases was 93.9% and response rate for controls was 100%. Risk factors of insulin refusal among poor glycaemic control includes age above 60 years old, tertiary level education, duration of diabetes less than 10 years, poor level of knowledge on insulin, fear on injection pain and fear to bruising due to injections. **Conclusion:** Hence, efforts must be taken to tackle the modifiable factors such as knowledge on insulin and diabetes, and fear on injections and bruises.

Keywords: Insulin refusal, Diabetes mellitus, Malaysia

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INTRODUCTION

Diabetes mellitus (DM) is a chronic disease characterized by hyperglycaemia as a result from the abnormalities in insulin secretion, insulin action, or both. The prevalence of diabetes was 6.4% affecting 285 million adults in 2010 and was projected to rise to 7.7%, and 439 million adults by 2030 globally (1).

In Malaysia, the prevalence of diabetes among adults in Malaysia is estimated to rise to 21.6% by the year 2020 (2). A study in Malaysia concluded that diabetes is a major public health problem with prevalence of T2DM is 20.8% affecting 2.8 million people (3). In Malaysia, the prevalence among the elderly is higher than the younger generation and it was reported that the prevalence of diabetes between the age 60-64 was 26.2% compared to the prevalence between age group 18-19 which was only 2.0% (4). According to the Third National Health and Morbidity Survey (NHMS III) of those with diabetes, it was reported 73.5% seek treatment from government healthcare facilities and 20% from private healthcare facilities. At the time of survey in 2006, oral anti-diabetic medications were given to 77% patients and only 7% received insulin therapy. However, there is an increase to 25.1% in those who received insulin therapy as reported in NHMS V (4). Among the known diabetics, 25.1% were on insulin therapy and 79.1 % claimed to be on oral anti-diabetic drugs (2).

A study in Johor reported the prevalence of HbA1C more than 6.5% was 68% with the mean of HbA1C detected at 7.8% (5). It was reported that poor glycaemic control could lead to high prevalence of micro-and macrovascular complications, such as neuropathy (19%), albuminuria (15.7%), retinopathy (11.1%), and microalbuminuria 6.6% (6). The management of diabetes involves lifestyle modifications, pharmacotherapy such as OADs and insulin and health education for patients to encourage

self-efficacy and empowerment (7). Glycaemic control is one of the parameter of target control of T2DM and it includes FBG level between 4.4 to 7.0 mmol/L, post-prandial blood glucose level between 4.4 to 8.5 mmol/L and HbA1C ≤ 6.5 %. The treatment algorithm for T2DM varies depending on both HbA1C and FBG levels (7).

Insulin is indicated for patients with poor glycaemic control and also to prevent complications (8). Insulin is often indicated for the management of poor glycaemic control of HbA1c ranging from 7.5% to 8.5% in combination with OADs to delay the development of microvascular and macrovascular complications (2). Triple combination therapy includes any three combinations of OAD and insulin for patients with HbA1C 8.5% to 10%. In patients with HbA1C > 10%, combination therapy coupled with basal/premixed insulin therapy is recommended.

Insulin refusal is defined as an act of unwillingness to accept insulin (9). In today's world, healthcare providers face great challenge in introducing or commencing insulin among type 2 diabetes mellitus (T2DM) patients (10). Insulin is indicated in diabetic patients, either based on symptoms such as severe hyperglycaemia leading to signs of diabetic ketoacidosis regardless of glycated hemoglobin (HbA1C) and fasting blood glucose (FBG) and in T2DM patient on maximal oral anti-diabetic (OADS) with HbA1C more than 7.0% (2).

The recent National Diabetes Registry Report 2016 showed the distribution of diabetes patients with HbA1C more than 8.0% in health clinics in Federal Territory of Kuala Lumpur was 32.81% and only 25.1% patients had HbA1C less than 6.5 % (11). Hence, it shows high percentage of poor glycaemic control among active and registered diabetic patients in the Federal Territory of Kuala Lumpur. The recent audit from 720 patients selected from National Diabetes Registry showed only 33.33% was on insulin therapy at Tanglin Health Clinic, Kuala Lumpur. A cross-sectional study done at 13 health clinics in Johor revealed 68% of patients with T2DM has poor glycaemic control but only 63.8% patients received insulin therapy alone and 58.3% on combination therapy of insulin and oral hypoglycemic agents (5). The objective of this study is to identify the risk factors of insulin refusal among T2DM patients (among the cases and controls) at the Tanglin Health Clinic, Kuala Lumpur.

MATERIALS AND METHODS

Study location, study design, sampling methods and variables

This study was conducted in Tanglin Health Clinic which is located in the Federal Territory of Kuala Lumpur. The design of study is case control. The study design is guided by the Strengthening the Reporting of Observational Studies in Epidemiological (STROBE) statement (12). The study was conducted from September 2017 to July 2018, while the data was collected from April until May 2018.The study population consists of T2DM patients with poor glycaemic control of more than 7.5% HbA1C in Tanglin Health Clinic in Kuala Lumpur. On average, 60 -80 patients come for follow up sessions at this clinic on a daily basis at this clinic daily from Monday till Thursday.

Stratified sampling method was employed based on insulin used status as a stratum. The sampling frame for cases were obtained from the list of T2DM patients who were indicated and offered for insulin but refused and controls consists of list of T2DM patients who were already on insulin. Cases were patients with HbA1C more than 7.5% but not on insulin therapy despite being offered by the doctor and control group consists of patients with HbA1C more than 7.5% but already on insulin therapy. First, patients with history of HbA1C more than 7.5% from the green book were selected based on colour coding from their NCD follow up record book. Next, individual's status on insulin usage were identified from the case notes and computer records. Then, stratification by their insulin status into insulin users and insulin refusal was conducted. From each strata, simple random sampling was done from both stratum (cases) and (controls) lists of patients attending the scheduled consultations. Their nearest appointment dates were identified and questionnaires was given to them on their consultation days. For this study, the sample size was calculated by using two proportion formula for case control study which is 230 for cases and 230 for controls (13).

Instruments

The study instrument used were questionnaire and patient's NCD record book. There are 5 main sections which are, section A on socio-demographic characteristics, section B on diabetes knowledge, section C on diabetes stigma, section D on physical factor (fear on injection and bruises), section E on social support. The questionnaire was adapted from validated instruments with permission granted from respective authors. This questionnaire was designed to facilitate the purpose of this study which is to identify the risk factors of insulin refusal among Type 2 Diabetes Mellitus patients with poor glycaemic control. The patients' NCD record books were used to trace the latest HbA1C level recorded in the book.

Section A: Socio-demographic Characteristics

This section contains socio-demographic characteristics including age, gender, ethnicity, marital status, education level, duration of diabetes and income level.

Section B: Diabetes Knowledge

The questions from this section were adapted from the Revised Diabetes Knowledge Test (DKT) instrument (14). There are 4 statements chosen from this instrument,

with 4 other statements were added accordingly. All were true statements. Respondents were asked to circle round either 'true', or 'false' or 'don't know'. Scoring system includes 1 mark for correct statement and 0 mark for wrong statement. Then total sum of scores were calculated (14).

Section C: Diabetic Related Stigma

This part of questionnaire assessed the diabetic related stigma such as insulin related stigma and social stigma on insulin therapy. The instrument used is Diabetic Stigma Assessment Scale (DSAS-2).15 A total of 17 items were included and scores given based on 5 points Likert Scale, 1 point for strongly disagree, 2 points for disagree, 3 points for unsure, 4 points for agree and 5 points for strongly agree.

The DAS-2 has 3 subscales which are, 'Treated Differently' were calculated by summing item scores on items 1,4,7,10,14,17 with possible range: 6-30 'Blame and judgement' calculated by summing item scores on items 2,3,8,12,16 possible range will be 6-30 and 'self-stigma' calculated by summing items scores on items 5,6, 9,11,13,15 with possible score range of 5-25 (15). The score was then categorized into low and high based on the formula [(maximum-minimum)/2] + minimum score.

Section D: Physical factor

In this section, no available instrument, thus patients were asked regarding their fear on injections of insulin and fear on bruising at injection site. They were asked to answer whether yes or no.

Section E: Social Support

In this section, questions on various dimension of social support were adapted and adopted from the Social Support Survey Medical Outcomes Study (SS) which consists of 11 items, item 1 will enquire about number of close friends and relatives whom ones feel at ease with and the other 10 items measures emotional support/ informational support (items 3, 4, 8, 13, 16, 19) and tangible support (items 2, 5, 12, 15). The score ranges from 1 to 5. Minimum score will be 1 and maximum score will be 50. A higher score indicates better social support. The score was then categorized into low and high based on the formula [(maximum-minimum)/2] + minimum score. Permission to use the instrument was obtained from the author (16).

Quality Control of study instrument

Face Validity

Face validity was based on the test at face value that was done among 25 patients from Tanglin Health Clinic Kuala Lumpur, who was not included in the study. High face validity showed more subjects were motivated to answer the questions. Some of the questions was modified and rephrased accordingly.

Content validity

The questionnaire was discussed with three experts in field of Public Health. Their comments were taken into considerations and corrections made accordingly. The corrections included on rephrasing and modifying the questions. Back to back translations done by the expert who has the Teaching English as Second Language (TESL) degree.

Reliability

Pre-test was done on 5 respondents per items on the largest instrument which is Diabetes Attitude Scale and was 85 respondents. To achieve good internal consistency before the actual study begins, this test was conducted on the 85 patients who were in the sampling population but not in the sampling frame. They were T2DM patients from Tanglin Health Clinic, Kuala Lumpur. Cronbach's Alpha was analysed using SPSS for internal consistency reliability. Cronbach's Alpha for all 4 sections with its domains reported in Table I.

Table I: Reliability Test Results

Section	Domain	Cronbach's Alpha
Knowledge on Insulin		0.645
Diabetes Stigma Assessment Scale		
	Treated Differently	0.725
	Blame and Judgement	0.791
	Self-stigma	0.858
Physical Factors		0.878
Social Support		
	Emotional Support	0.887
	Tangible Support	0.818

Ethical Approval

The study was registered first with National Medical Research Register. Ethical approval from the Medical Research and Ethics Committee Ministry of Health Malaysia, was obtained prior to data collection. Permission was obtained from State Health Department of Wilayah Persekutuan Kuala Lumpur and District Health Office in Wilayah Persekutuan Kuala Lumpur to conduct research at Tanglin Health Clinic. Informed consent from each respondent was included in the questionnaire in the Patient Information.

Analysis

Information from the questionnaire was entered into data file using statistical package of, IBM SPSS Statistics Version 23.0. Before data analysis, screening for any error or out of range error was done few times. Data analysis comprising descriptive, univariable and multivariable analysis were done. Descriptive statistics described characteristics of the respondent and assumptions on normality checked. Data transformation was made from continuous to categorical. Continuous variables that are normally distributed described as mean and standard deviations (SD). Chi Square test was used to measure

associations between two categorical variables. Simple logistic regression was done to determine the association between the continuous independent and categorical dependent data. Multiple logistic regression was used to determine the risk factors of insulin refusal among the T2DM patients with poor glycaemic control.

RESULTS

The response rate for control was 100%, and the response rate for cases was 93.9%. Altogether 3 patients were excluded in the final data analysis because of missing information on duration of diabetes. Therefore, the total number of patients which included in this study was 446.

Characteristics of Respondents

Socio-demographic Characteristics and Diabetic Profile

Majority of the study subjects were aged 60 years old and above (n = 238, 53.4%) especially among cases (55.6%). Majority of study subjects were females (58.1%) and Malays (74.7%). There is a significant difference in the distribution of ethnicity between cases and controls (Fisher'= 8.79, p = 0.027). Most of the study subjects were married (76.0%). Half of the recruited study subjects have secondary education (50.0%) while 29.6% have primary and lower education, followed by 20.4% with tertiary education. The proportion of cases with tertiary education was significantly higher among cases compared to controls (26.4% vs. 14.8%; χ^2 = 12.43, p = 0.006*). The proportion of insulin refusal was significantly higher among those who were diagnosed with diabetes less than 10 years (61.9% vs. 36.8%; χ^2 = 10.93, p <0.001) (Table II).

Knowledge on Insulin

A significantly higher proportion of cases have poor level of knowledge on insulin compared to controls (44.4% vs. 14.8%; χ^2 = 50.62, p <0.001) (Table II).

Diabetes Related Stigma

Most of study population have low diabetes stigma. There is no significant distribution was observed between cases and controls (Table II).

Physical Factors of Insulin Injection

Table II shows that majority of the study subjects were not fear of pain when injecting insulin (58.5%). Similarly, majority of study subjects were not fear of bruising due to injection (60.1%). However, a significantly higher proportion of cases be afraid of pain and bruises due to injection compared to controls (72.7% vs. 12.2%; χ^2 = 168.03, p <0.001 and 67.6% vs. 13.9%; χ^2 = 133.84, p <0.001 respectively) (Table II).

Social Support

Majority of the study subjects have high level of tangible support (61.9%); however, a higher proportion of cases

Table II: Distribution of study subjects by socio-demographic characteristic, knowledge, physical factor, diabetes stigma and social support.

Characteristics (n = 446)	Case	Control	χ^2	p-value
	n (%)	n (%)		
Age				
< 50	22 (10.2)	37 (16.1)	3.40	0.183
50 – 59	74 (34.2)	75 (32.6)		
≥ 60	120(55.6)	118(51.3)		
Gender				
Male	94 (43.5)	93 (40.4)	0.435	0.510
Female	122(56.5)	137(59.6)		
Ethnicity				
Malay	149(69.0)	184(80.0)	8.79[b]	0.027*
Chinese	22 (10.2)	10 (4.3)		
Indian	42 (19.4)	34 (14.8)		
Others	3 (1.4)	2 (0.9)		
Marital status				
Single	11 (5.1)	6 (2.6)	1.93	0.381
Married	161(74.5)	178(77.4)		
Widowed	44 (20.4)	46 (20.0)		
Educational level				
Primary education and lower	51(23.6)	81 (35.2)	12.424	0.002*
Secondary education	108(50.0)	115(50.0)		
Tertiary education	57 (26.4)	34 (14.8)		
Duration of Diabetes (n = 443)[a]				
< 10 years	133(61.9)	84 (36.8)	10.93	<0.001*
≥ 10 years	82 (38.1)	144(63.2)		<0.001*
Level of knowledge				
Poor	96 (44.4)	34 (14.8)	50.62	<0.001*
Moderate	66 (30.6)	87 (37.8)		
Good	54 (25.0)	109 (47.4)		
Treated Differently				
Low	203 (94.0)	206 (89.6)	2.86	0.091
High	13 (6.0	24 (10.4)		
Blame and judgement				
Low	147 (68.1)	151 (65.7)	0.29	0.590
High	69 (31.9)	79 (34.3)		
Self-stigma				
Low	173 (80.1)	190 (82.6)	0.47	0.495
High	43 (19.9)	40 (17.4)	0.47	0.495
Fear of injection pain				
Yes	157(72.7)	28(12.2)	168.3	<0.001
No	59(27.3)	202(87.8)		
Fear of bruises due to injection pain				
Yes	146(67.6)	32(13.9)	133.84	<0.001
No	70(32.4)	198(86.1)		
Tangible support				
Low	90 (41.7)	80(34.8)	2.24	0.135
High	126 (58.3)	150(65.2)		
Emotional/informational support				
Low	26 (12.0)	32 (13.9)	0.35	0.556
High	190 (88.0)	198(86.1)		

Note: [a] = 3 missing, [b] Fisher's Exact Test

have low tangible support compared to controls (41.7% vs. 34.8%). A higher proportion of cases have high emotional or informational support (88.0% vs. 86.1%). However, no significant difference was observed between cases and controls (Table II).

Crude Odds Ratio Associated with Insulin Refusal among Type II Diabetes Patients

This section presents the statistical results of association between socio-demographic characteristics, diabetic profile, knowledge on insulin, diabetes stigma, physical factor of injection, social support and insulin refusal among type II diabetes patients. Simple logistic regression was performed to determine the association between independent and dependent data. It is also carried out in order to screen for the most important variables to be entered into multivariate analysis model to further determine the risk factors for insulin refusal.

Association between Socio-Demographic Characteristics, Diabetes Profile and Insulin Refusal among Type II Diabetes Patients

Patients with tertiary education background found to increase insulin refusal more than 2.5 times higher (COR = 2.59, 95% CI = 1.09, 6.18) compared to those with lower education level. Higher duration of diabetes was associated with lower insulin refusal (COR = 0.89, 95% CI = 0.87, 0.93). Consistently, patients diagnosed with diabetes less than 10 years had increased chance of insulin refusal by more than two-fold (AOR = 2.78, 95% CI = 1.89, 4.09).

Association between Knowledge on Insulin and Insulin Refusal among Type II Diabetes Patients

Poor level of knowledge increases insulin refusal more than five times (COR = 5.70, 95% CI = 3.41, 9,48) (Table III).

Association between Physical Factors and Insulin Refusal among Type II Diabetes Patients

Physical factor such as fear to pain of insulin injections significantly increases the insulin refusal more than 19 times (COR = 19.19, 95% CI = 11.69, 31.51) while fear to bruises due to insulin injections are almost 13 times likely to refuse insulin (COR = 12.9, 95% CI = 8.07, 20.54) (Table III).

Risk Factors of Insulin Refusal

Based on simple logistic regression, variables were selected as the most important variables to be entered into the model based on selection criteria with $p < 0.05$ for 6 variables. However, 2 variable not significant with p value less than 0.25 were also included in the model because according to Hosmer and Lemmeshow recommended this p value when it was discovered that the use of the $p < 0.05$ used initially often fails to identify some variables that shows significance importance (17).

Therefore, 8 variables from univariable analysis were

Table III: Association between socio-demographic characteristics, diabetes profile, knowledge on insulin and diabetes, diabetes stigma, physical factor and social support with insulin refusal among type II diabetes patients

Characteristics (n = 466)	COR	95% CI	*p*- value
Age at recruitment (years)			
< 50	1.00		
50 – 59	1.66	0.90 – 3.08	0.108
≥ 60	1.71	0.95 – 3.07	0.072
Gender			
Male	1.14	0.78 – 1.65	0.510
Female	1.00		
Ethnicity			
Malay	0.54	0.09 – 3.27	0.503
Chinese	1.47	0.21 – 10.2	0.699
Indian	0.82	0.13 – 5.21	0.837
Marital status			
Single	1.92	0.65 – 5.63	0.236
Married	0.95	0.59 – 1.51	0.814
Widowed	1.00		
Educational level			
Primary and lower education	1.00		
Secondary education	1.92	0.96 – 2.31	0.074
Tertiary education	2.66	1.54 – 4.62	<0.001*
Duration of Diabetes (years)			
< 10 years	2.78	1.89 – 4.09	< 0.001*
≥ 10 years	1.00		
Level of knowledge			
Poor	5.70	3.43 – 9.49	< 0.001*
Moderate	1.53	0.97 – 2.42	0.068
Good	1.00		
Treated Differently			
Low	1.00		
High	0.55	0.27 – 1.11	0.949
Blame and Judgement			
Low	1.00		
High	0.90	0.61 – 1.33	0.590
Self-stigma			
Low	1.00		
High	1.18	0.73 – 1.90	0.495
Fear of pain when injecting insulin			
Yes	19.2	11.7 – 31.5	< 0.001*
No	1.00		
Fear of bruising due to injection			
Yes	12.9	8.07 – 20.6	<0.001*
No	1.00		
No of people to support			
0-5	1.14	0.54-2.43	0.73
6-10	0.94	0.42-2.09	0.88
11 and above	1.00		
Tangible support			
Low	1.34	0.91 – 1.97	0.135
High	1.00		
Emotional/informational support			
Low	0.85	0.49 – 1.47	0.556
High	1.00		

(*) – Significant at p <0.05

entered in multivariable analysis using the Enter method to obtain the p value and adjusted odds ratio with their 95% CI. In accessing the goodness fit of the model, the Hosmer-Lemmeshow test conducted showed that there was no significant difference (p = 0. 508) between the observed probability and the expected probability. Only a very small discrepancy existed between the observed and the expected probability which indicates that the model fits. The classification table showed that the overall percentage correct was good 82.8%. To access the model discrimination, the area under the ROC curve was determined. The area under the ROC curve (Figure 4.2) was 0.904, 95% CI = 0.876, 0.932), p < 0.001. This shows that the model discriminates 90.4% of the cases. The Nagelkerke R^2 value was 0.605. This indicates that 60.5% of the variation in insulin refusal explained by the logistic model.

Table IV shows that older patients (above 60 years old) increases the chance of insulin refusal by more than three folds (AOR = 3.93, 95% CI = 1.55, 9.97), compared to younger patients. Patients with tertiary level education were found significantly to have higher tendency of insulin refusal (eleven times) (AOR = 11.23, 95% CI = 4.71, 26.89) compared to those who have lower education background. Duration of diabetes lower than 10 years was significantly associated with insulin refusal (AOR = 3.48, 95% CI = 1.94, 6.25). Patients with poor insulin knowledge tend to refuse insulin by six times (AOR = 6.54, 95% CI = 3.21, 13.29). Fear to pain during insulin injections shows significant association with insulin refusal of more than 12 times (AOR = 12.26, 95% CI = 5.18, 29.00). Similarly, fear to bruising due to insulin injections shows significant association with insulin refusal by almost three times (AOR = 2.44, 95% CI = 1.04, 5.76).

Table IV: Multiple logistic regression analysis on risk factors of insulin refusal among poorly controlled type 2 diabetes mellitus patients in Tanglin Health Clinic, Kuala Lumpur

Variables	B	SE	AOR	95%CI	p-value
Age at recruitment					
<50			1.00		
50 -59	0.83	0.47	2.29	0.92 – 5.73	0.076
≥ 60	1.37	0.47	3.93	1.55 – 9.97	**0.004***
Marital status					
Single	-0.51	0.38	0.60	0.28-1.27	0.184
Married	-0.65	0.73	0.52	0.12-2.19	0.376
Widowed			1.00		
Education level					
Primary and lower education			1.00		
Secondary	1.26	0.37	3.53	1.72 – 7.24	**<0.001***
Tertiary	2.42	0.44	11.26	4.71 –26.89	**<0.001***
Duration of diabetes (years)					
< 10 years	1.25	0.30	3.48	1.94 – 6.25	**< 0.001***
≥ 10 years			1.00		
Level of knowledge					
Poor	1.88	0.36	6.54	3.22 –13.30	**<0.001***
Moderate	0.64	0.33	1.90	0.99 – 3.62	0.053
Good			1.00		
Physical Factor					
Fear to pain when injecting insulin					
Yes	2.51	0.44	12.26	5.18 –29.00	**<0.001***
No			1.00		
Fear of bruising due to injection					
Yes	0.89	0.44	2.44	1.04 – 5.76	**0.041***
No			1.00		

(*) – Significant at p <0.05

DISCUSSION

Age (i.e. above 60 years old), higher education level, duration of diabetes less than 10 years, having poor knowledge on insulin, fear on injection pain and fear on injection bruises are the factors that lead to insulin refusal among diabetes patients attending Tanglin Health Clinic, Kuala Lumpur.

This study shows that older patients (above 60 years old) have three times higher odds of insulin refusal compared to younger patients. In Tanglin Health Clinic Kuala Lumpur, majority of the patients who attend the diabetic clinic are pensioners. The reasoning for insulin refusal among the elderly aged group could be due to lack of exposure on health promotion and education on diabetes when they were diagnosed with diabetes. This is supported with the fact of our National Strategic Plan for Non-Communicable Disease 2010 which targeted and focused health promotion on the younger aged groups via strategic health promotion and education on non-communicable diseases in Malaysia (19). Thus, they lack in enthusiasm to accept insulin therapy. Similarly, a study conducted in Iran reported age is significantly associated with insulin refusal. It shows older patients have more tendency to refuse insulin as they perceive taking insulin makes life more complicated (20).

Education level showed significant association with insulin refusal. Patients with tertiary level education had eleven times higher odds of insulin refusal compared to those who have lower education background. Having a tertiary education not necessarily influence the patients to accept insulin as they behaviour and perceptions on insulin therapy influences their willingness to accept

insulin therapy. It may be explained by their over-confidence in their diabetes management and lack of time as most of these group prefers oral medications than insulin therapy. Most of the respondents with tertiary education background are working professionals and may have limited time to administer insulin at workplace or find it a hassle to administer insulin at their workplace.

Another possible factor that could contribute to refusal of insulin therapy among the patients with higher education level could be fear and misconception on long-term complications of insulin therapy (9). In contrast, this finding differs from many other studies. The study done in Singapore on perceptions of insulin therapy amongst Asian patients with diabetes reported tertiary education background was associated with a greater willingness to accept insulin (20). Similarly, another study in Singapore reported that patients with higher educational background were willing to accept insulin therapy (21). Tan et al reported that 55.0% patients were less likely to refuse insulin therapy have secondary education level and above (10). In both these studies, perceptions on insulin therapy plays important part in patients with higher education level and thus were more receptive in accepting insulin therapy (10,20). Nur Azmiah et al reported that there was no association between education level and insulin refusal (22). However, in this present study, having a tertiary education background may not be sufficient enough for accepting insulin therapy because these patients maybe lacking in knowledge pertaining on insulin usage and benefits.

The proportion of insulin refusal was significantly higher among those who were diagnosed with diabetes less than 10 years among the cases and control (61.9% vs. 36.8%; respectively). This could be due to the worsen glycaemic control among controls compared to the cases and thus in need of insulin therapy earlier. Duration of having diabetes less than 10 years significantly associated with insulin refusal. Patients who have diabetes less than 10 years are three times more likely to refuse insulin. A study in Kubang Pasu reported increase in one year of duration of T2DM reduces insulin refusal by 9.0% (10). Another study in Iran reported that duration of diabetes is significantly associated with unwillingness towards insulin therapy (19). The possible explanation could be longer time is needed for patients to understand the benefits of insulin. Thus, with proper exposure to counseling and health education on diabetes and insulin from time to time, patients could eventually have higher tendency to accept insulin therapy.

This study reported higher proportion of cases has poor level of knowledge on insulin compared to controls (44.4% vs.14.8%). Higher total score knowledge was associated with lower insulin refusal. This study shows poor level of knowledge increases insulin refusal. Patients with poor level of knowledge had six times higher odds of insulin refusal compared to patients with good level of knowledge. The reason behind this could be poor understanding on the benefits of insulin. This is explained by many qualitative and descriptive studies done worldwide. It is similar to the findings of a study in Torres Island whereby poor knowledge on insulin was found as the main contributing factor to the barriers of insulin therapy among type 2 diabetes patients with poor glycaemic control (23).

A study in Turkey revealed lack of knowledge on insulin such as benefits of insulin and mechanisms of actions of insulin contribute to unwillingness to take insulin (24). Lack of knowledge on insulin and its effectiveness maybe due to lack of effective communication between T2DM patients and the attending physicians (25). In Malaysian primary care, Hassan et al reported patient's concern on insulin is very much influenced by their knowledge on insulin. When they lack in knowledge on how to overcome hypoglycaemia attacks, they are prone to refuse insulin when offered insulin therapy by their doctors (26).

In generally, insulin injections can be perceived as painful. In this study, physical factor such as fear on insulin injections has the highest odds of insulin refusal among T2DM patients. Patients who fear injection pain refusal insulin by twelve times. Patients are reluctant to accept insulin therapy despite poor glycaemic control due to their biggest fear which is fear to injections. Some may have perception that taking insulin could be life-long therapy. Patients avoid insulin injection due to the anxiety and the concern on being injected on daily basis for the rest of their life (27). Thus, they prefer oral medications even after being counselled by their doctors for insulin therapy. Similar findings were reported in Singapore whereby fear of injections thought to be the most important barrier to accept insulin therapy ($p < 0.001$) (Wong et al, 2010). Many other studies have reported that the main contributing factor for insulin refusal is fear to injection pain (28,29).

In contrast to these studies, a prospective study done by Larkin et al reported that fear towards insulin injections is not the most important barrier to insulin therapy. This is due to other psychological insulin resistance factors such as negative attitudes towards hypoglycaemia effects and perception that insulin is needed life-long (30). As a conclusion, all these explains why the T2DM patients with poorly controlled diabetes see insulin therapy as the last resort. Hence, specific interventions can be carried out to overcome the fear of insulin injections among diabetes patients. This could be done by demonstration of injecting insulin on dummies or let the patients experience the injections using clear water with the insulin pen by doctors, pharmacists and

diabetic nurse at healthcare facilities.

Patients who fear of bruises have almost three times have higher odds of insulin refusal. Females generally fear pain towards bruises caused by injections and thus reluctant to accept insulin therapy (31).

The strength of this study was this is the first case control study done in Malaysia on insulin refusal among poorly controlled diabetes in primary care health settings. However, due to time constraint, the subjets of both cases and control could not be match. A matching case control study would have been a better study and should be done in future study.

CONCLUSION

High risk factors include age above 60 years old, duration of having diabetes less than 10 years, poor level of knowledge on diabetes and insulin, tertiary education level and physical factor (fear of injection pain and bruises).

Health education to enhance the knowledge on benefits of insulin is important to increase the acceptance of insulin therapy among poorly controlled diabetes. Educational materials should be catered in multiple forms to ensure better understanding on insulin among the target group. Thus, health education and promotion on insulin therapy must be done collectively by regular counselling by doctors, diabetic nurses and pharmacists. Apart from that, using insulin dummy injections with water can be performed with the consent from patients who fear injection pain.

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