HEALTH LITERACY AMONG ADULT TYPE 2 DIABETES MELLITUS (T2DM) PATIENTS IN KLANG HEALTH DISTRICT MALAYSIA

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Abstract

Introduction: Health literacy (HL) has been linked to various health outcomes among diabetics. However, there is no study exploring HL among diabetics within Malaysia.

Materials and methods: This cross-sectional study examined HL levels among Type 2 Diabetes Mellitus (T2DM) patients, and its association with glycaemic control.

Results: The response rate was 93.7%; whereby 289 T2DM patients from three public health clinics participated in the study between July 2018 and August 2018. 83.1% of the participants had limited HL (high likelihood of limited HL: 64.4%, adequate HL: 16.9%) and there was no association between HL and glycaemic control (P-value = 0.839). Forward logistic regression showed that limited HL was associated with age (OR 3.231; 95% CI 1.611-6.482) and education level (OR 7.290; 95% CI 3.547-14.984).

Conclusion: As our findings show, many T2DM patients have a limited HL, especially among those who are older and those who have a lower education level, diabetics should be consistently advised by using layman's terms to improve their understanding.

Keywords: *Diabetes mellitus, Glycaemic control, Health Literacy, Newest Vital Sign, Primary care*

Introduction

Globally, diabetes affects an estimated 415 million people (1), and is the seventh leading cause of death in 2016 (2). In Malaysia, the prevalence of diabetes has increased from 6.9% in 1996 to 17.5% in 2015 (3). However, it is reported that only 18.1% of diabetics have their diabetes under control (HbA1c < 6.5%) (4). Poor glycaemic control is of great concern as it leads to multiple complications such as nephropathy, ischemic heart disease, stroke, retinopathy, and foot ulcers. In addition, diabetes poses a huge economic burden, costing the nation an estimated RM 2 billion in 2011 (5). Over the past two decades, there has been a growing literature supporting that patients' health literacy (HL) has an influential role in minimizing the risks of complications among diabetics (6).

Health literacy is defined as "the individuals' capacity to obtain, process and understand basic health information and services needed to make appropriate health decisions" (7). Studies have shown that low or limited HL is common among diabetics especially among

those who are older, with a lower education attainment, lower income and of South Asian descent (6, 8-13). Diabetics with limited HL have been shown to have a poorer glycaemic control, greater prevalence of retinopathy, and poorer diabetes knowledge (9, 12-15).

Many studies on HL among diabetics are available but they are mostly conducted outside of Malaysia. Disparities in HL levels due to ethnicity have been reported whereby non-whites and people of minority have worse HL levels than whites (8, 14). Thus, providing limited generalizability in our local Malaysian population whereby important demographic and cultural differences persist. In addition, studies regarding HL among general Malaysians are limited (16, 17). Therefore, this study was conducted to examine the HL levels among adult T2DM patients in the public primary care health clinics within the Klang Health District, factors associated with limited HL and to analyse and discover if an association exists between HL and glycaemic control.

Methods

Setting and Study Participants

A cross-sectional study was conducted among patients who came for a follow-up in three government-funded health clinics in Klang, Selangor, Malaysia from 2nd July 2018 until 3rd August 2018. The sample size was calculated for a projected proportion of low HL among T2DM Malaysians of 79%. The margin of error was set at 5%. By using the sample size calculator OpenEpi, Version 3, and a confidence interval of 95%, the required sample size is 306 patients after the inclusion of a pre-set non-response rate of 20%.

Procedures and Measures

The participants were recruited using a convenient sampling method provided that they met the inclusion criteria: age ≥ 18 years old, diagnosed with T2DM for at least six months prior to the enrolment in the study, and were able to read, write and speak in the Malay language. The patients who agreed to participate in the study signed the consent form prior to the enrolment for the study.

The data was collected using a structured questionnaire consisting of three sections: a) patient demographic and lifestyle characteristics, b) HL level (measured using The Newest Vital Sign-Malay (NVS-M) tool (16), c) disease-related conditions. The collection of data for the first two sections were through a self-report, whereas data for the last section (disease-related conditions) was obtained from the patient's computerized records from their respective clinics.

The NVS tool developed by Barry Weiss and his associates was chosen as the HL tool because it was specifically designed for use in primary care setting (18), has been tested among diabetics (8-11); and has been used within Malaysia (16, 17, 19). Additionally, the NVS has been translated to the Malay language (NVS-M), with an acceptable reliability (Cronbach's alpha, α= 0.76) (16). The NVS consists of six questions based on a nutrition label. Each correct question is awarded one point. A score of 0-1 suggests a high likelihood of limited literacy, a score of 2-3 indicates the possibility of limited literacy and a score of 4-6 almost always indicates adequate literacy.

Data Analyses

All the statistical analysis was performed using the IBM® SPSS® Version 22.0 (20). Pearson's Chi-Square test was used for categorical data, while the one-way analysis of variance (ANOVA) was utilized for the continuous parametric data. For inferential analysis, both the simple and multiple logistic regression analyses were applied. P-values < 0.05 (two-sided) are considered statistically significant.

Ethical Approval

The study was approved by the Medical Research Ethics Committee (MREC), Malaysia (NMRR-18-820-40569 (IIR). A formal written approval was also obtained from the *Jabatan Kesihatan Negeri Selangor* (JKNS) to conduct the study in the Klang district. To ensure patient confidentiality, only de-identified data collected from the questionnaire were saved into an electronic file. No identifying information such as name, address, identity card number was saved into the password

protected file. A written approval was also obtained from Pfizer Inc.® to utilize the NVS-Malay (Copyright © Pfizer Inc).

Results

A total of 344 adults with diabetes were screened over the study period and 36 were ineligible because they were unable to speak/ read Malay (n=33), had T1DM (n=2), and was diagnosed with T2DM < 6 months (n=1). The response rate of the study was 93.7%; 289 of the 308 participants who met the inclusion criteria agreed to participate in the study. 19 eligible patients refused to join with the most common reason being a lack of time, followed by not being interested and no reason given. A comparison was made between the refusal group and the participants and no statistical differences (p-value >0.05) were observed in terms of age, gender and race.

Our study included 158 men and 131 women, aged between 28 and 78 years, with a mean age of 58.0±9.7 years, mean diabetes mellitus duration of 9.06±6.93 years and mean NVS score of 1.52 ±1.68. The majority of the participants were of Malay ethnicity (49.1%), had a mean BMI of 28.3±5.52kg/m^2 whereby 35.6% were obese, had at least a secondary school education (55%), monthly household income < RM2000 (45.7%), never smoked (67.1%), did not take alcohol (93.4%), do not exercise (33.6%), had limited HL [NVS score 0-3] (83.0%), were on oral antidiabetic agents alone (without insulin) (62.3%) and with an average HbA1c level of 8.3±2.0% whereby only 22.7% had tight glycaemic control of HbA1c ≤6.5%.

The proportion of patients stratified by their HL levels is shown in Table 1. The participants who had a high likelihood (n=186) and possibility of limited HL (n=54) were more likely to be of older age, having a lower education level and a lower monthly household income. For the secondary objectives of our study, the Chi-square analysis showed no significant difference in the mean HbA1c readings between the three groups of HL levels (p-value=0.839), indicating that the HL levels were not associated with the glycaemic control. However, we noted that all the three groups of HL levels had a poor glycaemic control (HbA1c > 6.5%).

Table 1: Characteristic of Participants Stratified by Health Literacy Level

Characteristics	Health Literacy Level			P-value[a]
	High likelihood of limited health literacy (n = 186)	Possibility of limited health literacy (n = 54)	Adequate health literacy (n= 49)	
Age (years)	59.6 ± 8.99	58.1 ± 9.43	51.8 ± 10.47	<0.001*
<56	62 (33.3)	18 (33.3)	32 (65.3)	<0.001*
≥56	124 (66.7)	36 (66.7)	17 (34.7)	
Gender, N (%)				
Female	88 (47.3)	22 (40.7)	21 (42.9)	0.646
Male	98 (52.7)	32 (59.3)	28 (57.1)	
Race/ethnicity, N (%)				
Malay	100 (53.8)	21 (38.9)	21 (42.9)	0.103
Chinese	36 (19.4)	19 (35.2)	15 (30.6)	
Indian	50 (26.9)	14 (25.9)	13 (26.5)	
BMI, mean (SD)	28.3 ± 5.58	27.8 ± 5.24	28.6±5.68	0.770
Education Level, N (%)				
No formal or Primary education	68 (36.6)	10 (18.5)	2 (4.1)	<0.001*
Secondary education	106 (57.0)	30 (55.6)	23 (46.9)	
Tertiary education	12 (6.5)	14 (25.9)	24 (49.0)	

Table 1 (cont.): Characteristic of Participants Stratified by Health Literacy Level

Characteristics	Health Literacy Level			
	High likelihood of limited health literacy (n = 186)	Possibility of limited health literacy (n = 54)	Adequate health literacy (n= 49)	P-value[a]
Monthly Household income, N (%)				
<RM2,000	99 (53.2)	21 (38.9)	12 (24.5)	<0.001*
RM2,000 – RM4,999	78 (41.9)	24 (44.4)	24 (49.0)	
≥ RM5,000	9 (4.8)	9 (16.7)	13 (26.5)	
Alcohol intake (Yes), N (%)	10 (5.4)	5 (9.3)	4 (8.2)	0.530
Smoking (Yes), N (%)				
Current smoker	32 (17.2)	8 (14.8)	8 (16.3)	0.987
Ex-smoker	31 (16.7)	8 (14.8)	8 (16.3)	
Never smoked	123 (66.1)	38 (70.4)	33 (67.3)	
Exercise (No), N (%)				
≥ 3 times a week	47 (25.3)	15 (27.8)	11 (22.4)	0.625
1 -2 times a week	37 (19.9)	11 (20.4)	13 (26.5)	
e	37 (19.9)	8 (14.8)	13 (26.5)	
Do not exercise	65 (34.9)	20 (37.0)	12 (24.5)	
e	9.6 ± 6.91	8.2 ± 6.42	7.8 ± 7.39	0.159
Treatment regimen, N (%)				
OAD agent(s) only	113 (60.8)	35 (64.8)	32 (65.3)	0.770
Insulin with/without OAD agent(s)	73 (39.2)	19 (35.2)	17 (34.7)	
HbA_{1c} level, mean (SD)	8.3 ±2.02	8.1 ± 1.73	8.3±2.07	0.839

[a]Pearson Chi-square test or One-way ANOVA test.
*p-value <0.05

The associations between patient characteristics and limited HL level were examined using both simple and multivariate logistic regression. To make the data more meaningful, the original three HL levels were dichotomized to two categories; adequate HL (NVS score ≥4) and limited HL (NVS score 0-3). Age, education level and monthly household income were found to be significantly associated with limited HL levels in the simple logistic regression analysis (Table 2).

Table 2: Factors associated with limited health literacy skills (NVS score ≤3) using simple logistic regression analyses.

Variable	Simple logistic regression			
	Regression	Crude OR	Wald statistics	P-value
Age(years)				
≥56	1.326	3.765(1.972 – 7.187)	16.149	<0.001*
≤55	0	1		
Gender				
Male	-0.121	0.886 (0.477 – 1.648)	0.145	0.703
Female	0	1		
Race/ethnicity				
Malay	0.304	1.356(0.729 – 2.520)	0.926	0.336
Non-Malay	0	1		
Education level				
Less than tertiary education	2.067	7.902 (3.954 –	34.236	<0.001*
Tertiary education	0	1		
Monthly household income				
< RM2,000	1.126	3.083 (1.533 – 6.200)	9.981	0.002*
≥ RM2,000	0	1		
Smoking status				
Current smoker	0.025	1.025 (0.446 – 2.351)	0.003	0.954
Ex-smoker or never smoked	0	1		
Alcohol intake				
Yes	-0.288	0.750 (0.238 – 2.365)	0.241	0.623
No	0	1		
Exercise				
<3 times a week	-0.185	0.831 (0.400 – 1.726)	0.246	0.621
≥3 times a week	0	1		
BMI (kg/m^2)				
≥30	-0.417	0.659 (0.351 – 1.239)	1.675	0.196
<30	0	1		
Years with diabetes				
≥10 years	0.275	1.317 (0.698 – 2.484)	0.724	0.395
< 10 years	0	1		
Diabetes medication				
Insulin with/without OAD	0.157	1.17 (0.615 – 2.226)	0.229	0.632
OAD agent(s) only	0	1		
HbA1c (%)	-0.025	0.975 (0.826 – 1.152)	0.087	0.768

After adjustment for the other variables, only age and education level remained significantly associated with limited HL skills (Table 3). Patients aged ≥ 56 years were 3.23 times (95% CI, 1.61 - 6.48) more likely to have limited HL than patients who were aged ≤ 55 years. The patients who had a lower education level had 7.29 times (95% CI, 3.55 – 14.98) greater odds of having limited HL than those who had a tertiary level education (Table 3).

Table 3: Factors associated with limited health literacy skills (NVS score ≤3) among T2DM patients in Klang Health District.

Variables	Adjusted OR[a] (95% CI)	Wald statistics[a] (df)	P-value[a]
Age(years)			
≤55	1.00		
≥ 56	3.231 (1.611 – 6.482)	10.905	0.001
Education level			
Tertiary education	1.00		
Less than tertiary education	7.290 (3.547 – 14.984)	29.205	<0.001
Monthly household income			
≥RM2,000	1.00		
<RM2000	2.103 (0.957 - 4.589)	3.457	0.063
BMI (kg/m^2)			
<30	1.00		
≥30	0.449 (0.181 - 2.914)	0.552	0.458

[a]Forward LR multiple logistic regression was applied

Discussion

The study reveals that a majority of diabetes patients had limited HL (83.0%). Although this figure was lower than the 94.2 – 95.0% reported by the two studies conducted within Malaysia (16, 19), this difference is possibly due to the higher percentage of participants having attained tertiary education in our present study. Our study found that the participants with higher education levels had higher HL levels of an individual and this is coherent with other studies (13, 21).

However, the percentage of limited HL among our participants is much higher when compared against studies conducted in the USA whereby the percentage of the study participants with limited HL ranged from 40.2-52.8% (8, 9). Meanwhile studies conducted in South Korea and Taiwan obtained results which were closer to our findings, whereby 71.5% and 76.3% of diabetic patients studied had limited HL respectively (10, 11). This observed difference, whereby patients from the Asian countries had a higher percentage of study participants with limited HL when compared to the USA, could possibly be explained by the HL measurement tool utilized. The NVS tool tests for HL by asking questions based on an ice cream nutrition label, which may be unfamiliar and less utilized by the Asian populations when compared to counterparts in the USA, as shown by a study conducted in the USA whereby the Korean immigrants who were less-acculturated to the food labelling practices had lower HL scores when compared

to individuals who were more acculturated (22). In the same study, the authors also noted that some participants mentioned that they did not eat ice cream, while some asked what the term "serving", mentioned as part of a question of the NVS tool, meant (22). This scenario was also observed in our study whereby the participants indicated that they had a hard time answering the questions because they mentioned verbally that they did not eat ice cream as stated in the NVS tool. A study conducted among the Malaysian university students also reported that more than half of their participants did not use nutrition labels mainly because they do not understand the terms on the package and find the information confusing (23). This lack of ability to understand information on a nutrition label among general Malaysians indicates a potential gap which should be targeted in future interventions especially among diabetic patients.

In our study, patients who are older and with a lower education attainment had greater odds of limited HL which is consistent with the findings from other studies (9, 15, 21). Despite some studies showing diabetic patients with inadequate HL levels having greater odds of poor glycaemic control (9, 12, 14, 15), which is in contrast to the findings of our study, other studies have also reported a lack of association between HL and glycaemic control (24-26). Therefore, systematic reviews suggest that there is no conclusive evidence to link HL directly to glycaemic control as the results are mixed (13, 21).

Although the findings of our study did not manage to show a significant association between HL levels and glycemic control, the results are beneficial as they show that there is a large proportion of T2DM patients with a limited HL and that the odds are higher among patients who are older and have a lower educational level. The findings are invaluable because older patients have been shown to be the most vulnerable group to ill-effects of diabetes complications and have higher chances of having more chronic medical conditions. Therefore, by having strategies that provide targeted interventions among this group of diabetic patients could potentially reduce the burden to our health care system. Healthcare providers should adjust their communication during consultations accordingly to patient's HL levels, avoiding medical jargon and utilizing layman's terms, especially since it has been shown that healthcare providers tend to overestimate their patient's HL levels, providing information in a level which is higher than a patient's capability (27). This gap between the patient's capabilities to understand health information provided by healthcare providers' can lead to a poor understanding and awareness about diabetes control.

Other than verbal communication, written materials such as educational pamphlets play an important role too, as it has been shown that the education level of the materials is usually higher than the education level of the patients (21). It has been suggested that healthcare providers should practice the teach-back or interview technique; whereby the patient will be asked to repeat or explain the gist of the consultation given to identify if the patients missed out on any important information, as this technique has been shown to be useful for patients with limited HL levels (28).

There are several limitations to our study. Firstly, our study is a cross-sectional study and therefore cannot prove a causal association between age and the education level with HL levels. Second, our findings do not reflect all T2DM populations in the country as our participants were selected from only three public health clinics in the Klang district of Selangor. Third, defaulters and patients who did not read or speak Malay language were not included in the study, giving rise to a possibility of bias in the results. Furthermore, our study did not measure the variables which have been shown to be potential confounders or mediators of HL such as diabetes self-management, provision of diabetes education, medication adherence levels, and the level of social support received.

In conclusion, limited HL is prevalent among T2DM patients under follow-up in public health clinics in the Klang Health District. This is worrying as it disproportionately affects older patients and those with a lower educational attainment, the same populations with a higher burden of chronic diseases and poorer health outcomes. While limited HL was not shown to be associated with a poorer glycaemic control in our study, a high percentage of patients had a poor glycaemic control, indicating an urgent need to improve control among our T2DM patients.

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