Malaysian Journal of Medicine and Health Sciences (ISSN 1675-8544)

ORIGINAL ARTICLE

Identifying self-care behaviour and its predictors among type 2 diabetes mellitus patients at a district of Northern Peninsular Malaysia

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ABSTRACT

Introduction: The prevalence of diabetes mellitus among Malaysian aged ≥ 18 years increased from 11.6% (2006) to 17.5% (2015). Positive self–care behaviour leads to good glycaemic control. The objective of this study is to determine the self-care behaviour, its associated factors and predictors among type 2 diabetes mellitus (T2DM) patients in government health clinics at a district of Northern Peninsular Malaysia. **Methodology:** A cross-sectional study was conducted on 546 T2DM patients aged ≥ 18 years, recruited by simple random sampling method. A validated self-administered questionnaire including socio-demographic characteristics, diabetes profile, knowledge, Health Belief Model (HBM) and Summary of Diabetes Self-care Activity Scale (SDSCA) was used. Data were analysed using SPSS version 22.0. Self-care behaviour is the dependent variable. **Results:** The respondents practised 3.4 (SD = 1.11) days self-care behaviour past 1 week. The predictors of self-care behaviour were self-efficacy (standardized β = 0.257, $p < 0.001$), knowledge (standardized β = 0.112, $p = 0.007$), female (standardized β = 0.107, $p = 0.010$), combination oral hypoglycaemic agents (OHA) and insulin (standardized β = -0.182, $p = 0.002$), and monthly income < RM1,000 (standardized β = -0.129, $p = 0.002$). The entire group of variables significantly predicted self-care behaviour [$F(6, 539) = 15.79$, $p < 0.001$, adjusted $R^2 = 0.140$] with total variance of 14.9%. Self-efficacy was the strongest predictor in self-care behaviour. **Conclusion:** The findings enable us to identify the specific groups with predicted lower self-care behaviour which are useful in future planning and implementation of intervention.

Keywords: Self-care behaviour, Health Belief Model, type 2 diabetes mellitus

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INTRODUCTION

Diabetes mellitus (DM) is one of the four major non-communicable diseases, it was the 8th leading cause of death worldwide in 2012, majority from low and middle income countries.(1) International Diabetes Federation projected that 1 in 11 adults worldwide suffered from DM in 2015.(2) The increasing trend in obesity, hypertension and urbanization are among the reasons of global increase in the prevalence of T2DM.(3)

Based on National Health and Morbidity Survey of Malaysia, in 2006 the prevalence of DM among Malaysian aged ≥ 18 was 11.6%; within 9 years the prevalence had increased to 17.5%.(4,5) The concern is on the rising diabetes prevalence, the poorly glycaemic control throughout the country is also alarming. This can be seen in the National Diabetes Registry (NDR) report 2009-2012, only 23.8% of the audited Malaysian DM patients in 2012 had haemoglobin A1c level < 6.5%, which is the Malaysia glycaemic control target.(6) Poorly controlled DM leads to macrovascular and microvascular complications. Once patients end up with diabetes complication, there is a certain degree of compromised quality of life.(7)

The fundamental of diabetes management is having good glycaemic control and prevent diabetes complication. Empowering patients managing their disease is vital as patients need to modify their lifestyle to optimize their glycaemic control. Diabetes self-care is daily activity that should be performed by the DM patients to manage the disease.(8) It includes blood glucose monitoring, medications compliance, physically active, healthy diet, good coping skills, efficient problem-solving skills, and risk-reduction behaviour.(9) Self-efficacy is individual's

belief in his capability to practise a given action, it is an important factor influencing self-care behaviour. Desired self-care behaviour facilitates good glycaemic control.(10) Despite of the well-known benefit of self-care, the level of self-care among T2DM patients still far beyond optimum, generally they just practised self-care about 3 days in a week.(11,12)

There are multiple factors associated with the practice of self-care behaviour. In term of socio-demographic factors, the association of age, gender, employment status, marital status, monthly income with the practice of self-care behaviour were controversial in different studies.(11–17) Few studies found that those with higher educational level have better self-care behaviour. (13,14,17) The desired practice of self-care behaviour is directly associated with longer duration of DM and type of diabetes treatment.(11,14) Studies showed that patients with better knowledge in DM tend to more readily to adopt self-care behaviour.(18–20)

In order to understand the patients' self-care behaviour, it is essential to explore individual factors that lead to such behaviour. Health Belief Model (HBM) is a psychosocial model that explore individual's belief and perception towards a disease and further explain his behavioural change. It was first developed by few social psychologists in 1950s to explain the failure of tuberculosis health screening offered by the public health service.(21) Since then, it has been widely used in studies explaining the behaviour change towards communicable and non-communicable diseases. Health Belief Model is efficient in predicting the self-care behaviour among T2DM patients.(15,16) Perceived susceptibility, perceived severity, perceived benefit, cue to action and self-efficacy are associated with desired self-care behaviour whilst perceived barrier is associated with poorer self-care behaviour.(12,16,17,22)

There are limited local behavioural studies to date in exploring the individual's belief that predicts self-care behaviour. Most diabetes management at present are focussed on improving the capacity of health care providers and diabetes care services. This study is to determine the self-care behaviour and its predictors using Health Belief Model (HBM) among T2DM patients that attended the government primary care facilities in a district of Northern Peninsular Malaysia. By understanding the predictors and barriers of self-care behaviour, it facilitates the future planning and implementation of DM intervention.

MATERIAL AND METHODS

Design, setting and sample selection

An analytical cross-sectional study was conducted from September 2016 to August 2017, data was collected from all four government health clinics located in a district of Northern Peninsular Malaysia to fulfil the minimum sample size of 662 after approval from district health director. Using the sampling frame of the list of T2DM patients who were given appointment for follow up in these four clinics, simple random sampling method was used via random number generator online version. Samples were calculated proportionate to the size of the total number of T2DM patients expected to attend the respective diabetes clinics appointment. In total, 662 eligible respondents were recruited based on the multiple linear regression sample size formula after taking into account of 20% of missing data and non-respondents.(23) The T2DM patients aged ≥ 18 years and had been diagnosed ≥ one year were recruited into the study, exclusion criteria were patients with gestational diabetes, illiterate, blind and deaf, those with concomitant psychiatry illness and non-Malaysian. The T2DM patients were identified as those who had been diagnosed and under regular follow up for the disease, the classification of T2DM is based on the patient's diabetes record. The dependent variable was the mean of total self-care behaviour score whilst the independent variables were socio-demographic characteristics, diabetes profile, diabetes knowledge and Health Belief Model constructs.

Instruments

There were five sections in the questionnaire.
Section A is socio-demographic characteristics details which include age, gender, educational level, employment status, marital status and monthly income. Section B is diabetes profile that includes self-reported duration of T2DM and type of diabetes treatment.

Section C consists of Summary of Diabetes Self-care Activity Scale (SDSCA) which assesses the respondents' self-care behaviour for the past one week prior to the survey.(24) The Malay version of SDSCA was adopted from Ahmad Sharoni (2015) whose study was conducted in Kelantan, Malaysia.(13) This section consists of 11 items which assess diet (2 items), physical activity (2 items), blood sugar monitoring (2 items), foot care (2 items) and smoking status (1 item). The evaluation was based on 7-point Likert scale ranged from 0 (never done) to 7 (7 days a week) for item 1-10. As for item 11 which assessed the smoking status, the smoker scored 0 whilst non-smoker obtained 1 mark. The total self-care behaviour mean score was calculated by sum of scores of items from diet, physical activity, blood sugar monitoring and foot care then divided by 10. Smoking item was not included in the calculation of mean score. Those with higher mean score practise better self-care behaviour.

Section D assesses respondents' knowledge in diabetes complications (6 items) and risk factors (7 items), which was adopted from Tan (2004) who conducted the study in Malacca, Malaysia.(25) The correct answer would score 1 whilst false answer or "not sure" would get 0.

The total scores range from 0-13, the higher score in this section indicates better knowledge in diabetes.

Section E is the 6 constructs of Health Belief model, the questions were adapted from Tan (2004) who developed her instrument in English language from 65-item Diabetic Health Belief Model Scale designed by Schwab (1994) initially.(25,26) It consists of perceived susceptibility (6 items), perceived severity (6 items), perceived benefit (7 items), perceived barrier (8 items), cue to action (5 items) and self-efficacy (10 items). All items used 5-points Likert scale which range from 1 (strongly disagree) to 5 (strongly agree) except for cue to action items which use the option of "yes" or "no". Higher scores in the construct reflects higher perceptiveness in that construct.

Validity and Reliability
Self-administered questionnaire was used in data collection, the original English language questionnaire was direct translated and back translated to Malay and Chinese languages. Content validity of the questionnaires was performed by a panel of two public health specialists, three family medicine specialists and one diabetic educator, another six T2DM patients who were not from the study population performed the face validity. The necessary modification was done based on the recommendations. Pre-test was conducted on 106 T2DM patients from another district of Northern Peninsular Malaysia. The internal consistency reliability tests of Cronbach's alpha ranged 0.566-0.917.

Ethical Consideration
The approvals were obtained from Ethics Committee for Research Involving Human Subjects, Universiti Putra Malaysia (JKEUPM) and National Medical Research and Ethics Committee (NMREC) of National Institute of Health, Ministry of Health Malaysia prior to data collection.

Data Analysis
SPSS 22.0 was used for data entry and analysis. Frequency and percentage was used for qualitative data (socio-demographic characteristics and type of diabetes treatment). For quantitative data, mean ± standard deviation was calculated for normally distributed data whilst median with interquartile range were used for skewed data. Data transformation was performed for skewed data prior to bivariate and multivariate analyses. In order to determine the association between dependent variable and continuous independent variables, Pearson's correlation followed by simple linear regression were used. For the association of dependent variable with categorical independent variables, dummy variables were formed prior to simple linear regression. The significant ($p < 0.05$) variables from the bivariate tests were included in hierarchical multiple linear regression to identify the predictors of self-care behaviour.

RESULTS

Response Rate
Total of 546 out of 662 eligible T2DM patients participated in the study with the response rate of 82.5%, 68 patients were not consented and 48 incompletes answered of questionnaires.

Socio-demographic Characteristics
Table 1 shows the distribution of respondents according to socio-demographic characteristics. More than half (51.5%) of the respondents were aged 40-60 years, gender distribution is almost equal. Majority of the respondents had secondary educational level (42.1%), employed (46.9%), married (88.6%) and with individual monthly income of <RM1,000 (61.5%).

Diabetes Profile
As for duration of having DM from Table 1, 35.7% of the respondents diagnosed within 5-<10 years. In terms of mode of diabetes treatment, those solely on oral hypoglycaemic agents (OHA) made up the majority of respondents (71.8%).

Knowledge
Generally, the diabetes knowledge on complications and its risk factors among the respondents were good. The median (IQR) scores for diabetes complications were 5.00 (1.00) with minimum and maximum scores of 0.00 and 6.00, whilst the median (IQR) scores for risk factors were 6.00 (2.00) with minimum and maximum scores of 0.00 and 7.00.

Health Belief Model
Table 2 reveals the total scores of six Health Belief constructs. The respondents had high cue to action with the mean (SD) score of 4.46 (1.08), observed minimum score of 0.00 and maximum score of 5.00. In comparison, the respondents had relatively low perceived barrier score with mean (SD) score of 20.29 (3.83) out of observed scores ranged 8.00-34.00.

Self-care Behaviour
In general, the respondents practised 3.4 days of self-care for the past one week prior to the survey as shown in Table 3. Under self-care behaviour, four subgroups were being assessed namely diet, exercise, self-monitoring of blood sugar (SMBG) and foot care. Diet control is the best practised self-care by the respondents with average of 4.2 days practice in a week. SMBG was the least self-care being performed by the respondents with only 2.2 days in past one week.

Association between Self-Care Behaviour and Socio-demographic Characteristics
The association of self-care behaviour with socio-demographic characteristics is shown in Table 4. Female respondents ($p = 0.034$) and those with university or

Table 1. Distribution of respondents by socio-demographic characteristics and diabetes profile (N=546)

Variables	No. of respondents (n)	Percentage (%)
Age (years)		
< 20	1	0.2
20 - < 40	45	8.2
40 - < 60	281	51.5
≥ 60	219	40.1
Gender		
Male	281	51.5
Female	265	48.5
Educational level		
No formal	74	13.6
Primary	185	33.9
Secondary	230	42.1
University/ college	57	10.4
Employment status		
Unemployed	86	15.8
Employed	256	46.9
Retired	81	14.8
Housewife	123	22.5
Marital status		
Single	16	2.9
Married	484	88.6
Widow/ widower	32	5.9
Divorce	14	2.6
Monthly income (RM)		
< RM1000	336	61.5
RM1000 - < 2500	154	28.2
RM2500 - < 5000	51	9.3
≥ RM5000	5	1.0
Duration of diabetes mellitus (years)		
< 5	173	31.7
5 - <10	195	35.7
10 - <15	113	20.7
≥ 15	65	11.9
Type of treatment		
Diet control only	32	5.9
Diabetes pills only	392	71.8
Insulin only	31	5.7
Diabetes pills and insulin	91	16.6

Table 2. Total scores of Health Belief Model constructs of the respondents

Variables	Mean (SD)	Median (IQR)	Possible score range	Observed score range
Health Belief Model				
Perceived susceptibility	19.51 (4.28)	19.00 (8.00)	6.00-30.00	7.00-30.00
Perceived severity	17.40 (1.83)	18.00 (3.00)	6.00-24.00	11.00-24.00
Perceived benefits	25.71 (3.92)	26.00 (6.00)	7.00-35.00	7.00-35.00
Perceived barriers	20.29 (3.83)	20.00 (6.00)	8.00-40.00	8.00-34.00
Cue to action	4.46 (1.08)	5.00 (1.00)	0.00-5.00	0.00-5.00
Self-efficacy	36.94 (5.37)	39.00 (9.00)	10.00-50.00	14.00-50.00

Table 3. The self-care behaviour (days) of respondents over the past 1 week

Self-care behaviour	Mean (SD)	Median (IQR)
Self-care	3.41 (1.11)	3.40 (1.40)
Diet	4.22 (1.18)	4.25 (2.00)
Follow healthy eating plan in past 1 week	4.49 (1.81)	5.00 (3.00)
Follow healthy eating plan in past 1 month	4.37 (1.77)	5.00 (3.00)
Eat ≥ 5 servings of fruits and vegetables	3.91 (1.89)	4.00 (2.00)
Eat high fat food such as red meat or full-fat dairy products	2.89 (1.64)	3.00 (2.00)
Exercise	3.70 (1.98)	4.00 (3.00)
≥ 30 minutes of physical activity	4.12 (2.05)	4.00 (4.00)
Participate in exercise	3.28 (2.27)	3.00 (4.00)
Blood Sugar Testing	2.24 (1.89)	2.00 (3.00)
Test blood sugar	2.36 (1.99)	2.00 (3.00)
Test blood sugar according to number of time recommended by health care provider	2.13 (1.89)	2.00 (2.00)
Foot care	2.68 (2.23)	2.25 (4.00)
Foot checking	2.77 (2.37)	2.00 (4.00)
Inspect the inside of shoes	2.59 (2.35)	2.00 (4.00)

college educational level (p = 0.003) had significantly direct linear association with self-care behaviour. In contrast, respondents without formal education (p = 0.011), those whose monthly income < RM1000 (p = 0.005) and earned RM1000-<RM2500 per month (p = 0.015) had significantly negative linear association with self-care behaviour.

Association between Self-Care Behaviour and Diabetes Profile

In term of association with diabetes profile seen in Table 4, the respondents who was on combination therapy of OHA and insulin had significantly lower self-care behaviour (p = 0.003).

Association between Self-Care Behaviour and Knowledge

From Table 4, those respondents with higher diabetes knowledge had significantly better self-care behaviour (p < 0.001).

Association of Self-Care Behaviour with Health Belief

Table 5 shows perceived benefit (p < 0.001), cue to action (p = 0.001) and self-efficacy (p < 0.001) had significant direct linear relationship with self-care behaviour, in contrast perceived barrier (p = 0.008) had significant indirect linear association with self-care behaviour.

Table 4. Association of self-care behaviour with socio-demographic characteristics, diabetes profile and knowledge

Socio-demographic Characteristics	Self-care behaviour			
	Pearson's correlation	Simple linear regression		*p* value
		Standardized βeta	95% CI	
Age	-0.077	-0.007	-0.015, 0.001	0.072
Gender				
Male (Reference group)	-	-	-	-
Female	-	0.200	0.015, 0.385	0.034*
Educational level				
No formal	-	-0.383	-0.676, -0.089	0.011*
Primary (Reference group)	-	-	-	-
Secondary	-	0.043	-0.168, 0.253	0.692
University/ college	-	0.496	0.172, 0.819	0.003**
Employment status				
Unemployed	-	-0.159	-0.463, 0.146	0.307
Employed	-	0.082	-0.156, 0.319	0.499
Retired	-	0.211	-0.099, 0.521	0.182
Housewife (Reference group)	-	-	-	-
Marital status				
Single (Reference group)	-	-	-	-
Married	-	0.005	-0.548, 0.558	0.986
Widower/ widow	-	-0.156	-0.822, 0.510	0.645
Divorce	-	-0.097	-0.893, 0.699	0.810
Monthly income				
<RM1000	-	-1.369	-2.329, -0.409	0.005**
RM1000 - <RM2500	-	-1.206	-2.174, -0.238	0.015*
RM2500 - <RM5000	-	-0.705	-1.704, 0.293	0.166
≥RM5000 (Reference group)	-	-	-	-
Duration of diabetes [a]	-0.057	-0.187	-0.455, 0.087	0.183
Type of diabetes treatment				
Diet control (Reference group)	-	-	-	-
Diabetes pills	-	-0.227	-0.621, 0.167	0.258
Insulin	-	-0.010	-0.550, 0.530	0.971
Diabetes pills and insulin	-	-0.674	-1.115, -0.234	0.003**
Knowledge [b]	0.203	0.000362	0.000, 0.001	<0.001**

Note: **p<0.01 (2-tailed)
*p<0.05 (2-tailed)
[a] Using log 10 transformation
[b] Using power 3 transformation

Predictors of Self-care Behaviour

By using hierarchical multiple linear regression in Table 6, self-efficacy (β = 0.257, $p < 0.001$), knowledge (β = 0.112, $p = 0.007$) and female gender (β = 0.107, $p = 0.010$) significantly predicted desired self-care behaviour. Respondents on combination therapy of OHA and insulin (β = -0.182, $p = 0.002$), monthly income <RM1000 (β = -0.129, $p = 0.002$) were the negative predictors of self-care behaviour. Respondents on OHA solely was not a significant predictor. The above variables significantly predicted self-care behaviour [$F(6, 539) = 15.79$, $p < 0.001$, adjusted $R^2 = 0.140$] with total variance of 14.9%. Self-efficacy was the strongest predictor of self-care behaviour.

DISCUSSION

Self-care Behaviour

American Association of Diabetes Educators pointed out seven effective self-care behaviour for efficient diabetes management which includes healthy diet, physically active, monitoring blood glucose, adherence to medications, healthy coping skills, problem solving skills and risk reduction behaviour.(9) In the current study that used the Summary of Diabetes Self-care Activities Scale (SDSCA), the respondents practised self-care for about 3.4 days in a week. Büyükkaya Besen et al. (2016) and Reisi et al. (2016) who used similar scale in their studies in Turkey and Iran reported that their T2DM patients practised self-care for 3.0 days and 3.8 days respectively in the past one week.(11,12) Self-care behaviour is the essential aspect in diabetes management. Good self-care behaviour improves glycaemic control and prevents diabetes complication.(27) In usual practice, the health care providers just advise the T2DM patients on the necessity of practise self-care without specifically mentioning the days needed to achieve desired self-care, this might create confusion among patients. Thus, by knowing the days of current self-care practice, providers can set an attainable goal for the patients in improving the days of practising self-care behaviour.

Compliance to diabetes healthy diet is the component best practised by the respondents with the average of 4.2 days per week. Gunggu et al. (2016) found that the Sarawak Malaysian T2DM patients followed diabetic diet in an average of 5.5 days in a week,(28) while Ahmad Sharoni et al. (2015) revealed the elderly T2DM patients in Malaysia controlled their diet in 4.4 days a week.(13) Diabetic diet compliance is vital in diabetes management as it has direct effect on the glycaemic control. The low fat meat and dairy free vegan diet more effectively in improving glycaemic control as well as lipid profile than the conventional diabetes diet recommendations in T2DM individuals.(29) High fibre diet is recommended in DM individuals as it improves glycaemic control and prevents diabetes complications.(30) Recommended diabetes diet needs to be customized to local menu to increase the uptake among T2DM patients.

The respondents stayed physically active for at least 30 minutes in 4.1 days a week and spent 3.3 days to exercise in a week. In Kelantan, the elderly T2DM patients only exercised 1.6 days per week.(13) Malaysia National Health and Morbidity Survey (NHMS) 2015 revealed that 66.5% of the adult general population were physically active.(5) However in a study among Sarawakian T2DM patients in Malaysia, 29.1% of them were physically active and only 4.1% exercised for at least 5 days in a week.(28) These reflected high level of physically inactive among T2DM individuals. Among the reasons of physical inactiveness among DM patients were due to lack of time and exercise facilities, perceived difficulty

Table V. Association of self-care behaviour with Health Belief

Variables	Self-care behaviour			
	Pearson's correlation	Simple linear regression		*p* value
		Standardized βeta	95% CI	
Health Belief				
Perceived susceptibility [a]	-0.045	-0.000305	-0.001, 0.000266	0.294
Perceived severity [a]	0.004	0.000066	-0.001, 0.002	0.930
Perceived benefit [a]	0.150	0.001	0.000, 0.001	<0.001**
Perceived barrier [b]	-0.113	-0.295	-0.513, -0.077	0.008**
Cue to action	0.145	0.148	0.063, 0.233	0.001**
Self-efficacy [a]	0.301	0.001	0.000631, 0.001091	<0.001**

Note: **p<0.01 (2-tailed)
*p<0.05 (2-tailed)
[a] Using power 2 transformation
[b] Using square root transformation

Table VI. Hierarchical multiple regression for predictors of self-care behaviour (N=546)

Self-care Behaviour	Unstandardized Coefficients		Standardized Coefficients			
	B	Standard Error	βeta	t	*p* value	R^2 change
Model 1						0.090
Constant	2.211	0.169		13.061	<0.001	
Self-efficacy [a]	0.001	0.000117	0.301	7.354	<0.001	
Model 2						0.018
Constant	2.044	0.175		11.658	<0.001	
Self-efficacy [a]	0.001	0.000120	0.267	6.376	<0.001	
Knowledge	0.000245	0.000074	0.137	3.284	0.001	
Model 3						0.014
Constant	2.165	0.179		12.113	<0.001	
Self-efficacy [a]	0.001	0.000119	0.260	6.244	<0.001	
Knowledge [b]	0.000218	0.000074	0.122	2.921	0.004	
Diabetes pills and insulin	-0.359	0.121	-0.121	-2.979	0.003	
Model 4						0.006
Constant	2.388	0.211		11.334	<0.001	
Self-efficacy [a]	0.001	0.000119	0.264	6.359	<0.001	
Knowledge [b]	0.000217	0.000074	0.122	2.927	0.004	
Diabetes pills and insulin	-0.598	0.170	-0.202	-3.512	<0.001	
Diabetes pills	-0.279	0.141	-0.114	-1.981	0.048	
Model 5						0.010
Constant	2.511	0.215		11.662	<0.001	
Self-efficacy [a]	0.001	0.000118	0.265	6.416	<0.001	
Knowledge [b]	0.000198	0.000074	0.111	2.669	0.008	
Diabetes pills and insulin	-0.537	0.171	-0.181	-3.137	0.002	
Diabetes pills	-0.239	0.141	-0.097	-1.692	0.091	
Monthly income < RM1000	-0.232	0.092	-0.102	-2.512	0.012	
Model 6						0.011
Constant	2.475	0.215		11.536	<0.001	
Self-efficacy [a]	0.001	0.000118	0.257	6.230	<0.001	
Knowledge [b]	0.000199	0.000074	0.112	2.686	0.007	
Diabetes pills and insulin	-0.539	0.170	-0.182	-3.164	0.002	
Diabetes pills	-0.252	0.140	-0.103	-1.792	0.074	
Monthly income < RM1000	-0.292	0.095	-0.129	-3.084	0.002	
Female	0.236	0.091	0.107	2.592	0.010	

Note: [a] Using power 2 transformation, [b] Using power 3 transformation,
Model 6 F (6, 539) = 15.79, $p < 0.001$, $R^2 = 0.149$, adjusted $R^2 = 0.140$

in uptake of exercise, and tiredness.(31) Physical activity is able to reduce the risk of cardiovascular mortality up to 35%,(32) this is important in DM patients as they are subjected to high risk of cardiovascular diseases.

The foot care practice among the respondents was low, they just performed foot care in 2.7 days a week. Another study in Malaysia also noticed the T2DM individuals practised foot care 1.9 days in a week.(13) Only 34.0% of the Sarawak Malaysian T2DM patients examined their foot everyday.(28) Foot self-examination behaviour is significantly associated with diabetes foot ulcer risk.(33) Study showed that diabetic neuropathy was already presented in 5.7% and 2.4% of the Germany and UK newly diagnosed T2DM patients respectively. (34) Thus foot care should be practised by all patients to have early detection of diabetes foot ulcer and prevent foot amputation.

Among the self-care behaviours being assessed, blood glucose testing was the lowest self-care being practised with only 2.2 days in a week. In another study in Iran and Malaysia also noted the self-monitoring of blood glucose (SMBG) was the lowest trend of self-care being performed among T2DM patients with only 1.7 days and 1.2 days per week respectively.(12,13) Many DM patients are not aware of the importance of SMBG in diabetes management.(35) The barriers of SMBG are lack of self-efficacy, scare of pain and needle, the affordability of the strips and needles, stigma and misconception that SMBG is only for insulin injectors.(36) The uptake of SMBG will only increase with effective measures to overcome the identified barriers.

Association of Self-Care Behaviour with Socio-demographic Characteristics

Female gender was significantly associated with desired diabetes self-care. A qualitative study in Canada showed that female T2DM patients were more readily to disclose their disease to their friends and families, they incorporate diabetes management into their daily lives as compared to men.(37) Furthermore, female patients restricted their diet more than men in glycaemic control. (37) In contrast, several studies conducted in Turkey, Iran and Malaysia did not notice significant difference among both genders in practising self-care behaviour. (11,13,15)

Educational level was showed to have significant association with self-care behaviour, those who attended university or college had significant better self-care behaviour whilst poorer self-care behaviour was seen among respondents without formal education. Several studies in Malaysia and Ethiopia found that illiterate tend to have poorer diabetes self-care.(13,17,18) Sharoni and Wu's study revealed that tertiary educational level T2DM patients had higher confidence in performing SMBG as compared to patients with primary and secondary educational level.(14) Study showed that higher educational level patients had higher health literacy. (12) They usually have better comprehension on the health information and DM treatment regime, which increase their confidence level in performing diabetes self-care.

Respondents with lower monthly income were significantly associated with poorer self-care behaviour, this could be seen especially in those who earned <RM2500 monthly. In India, the higher socioeconomic T2DM patients check their blood glucose more frequently.(38) Usually the higher income individuals have more exposure to resources that facilitate their diabetes management, glucometer is affordable to them thus indirectly encourage them to perform SMBG. Besides, they also have better access to healthy food as healthy food usually relatively more expensive. Study in Ethiopia had controversial finding where those patients from higher income group were 0.2 times less likely to perform self-care behaviour. (17) Study in Turkey showed no significant association between self-care and income. (11)

This study did not note any significant association between self-care behaviour with age, employment and marital status.

Association of Self-Care Behaviour with Diabetes Profile

In term of type of diabetes treatment, those on combination therapy of oral hypoglycaemic agent and insulin have significant lower self-care behaviour. A Malaysia study using data retrieved from Adult Diabetes Control and Management (ADCM) Registry 2008-2009 found that those on combination therapy had poorer glycaemic control.(39) This can be explained as the poor self-care patients usually have poor glycaemic control which ends up with the need of combination treatment regime to control the disease. The study in Iran had different finding where the T2DM patients on OHA solely had significant poorer self-care as compared to other treatment regime.(11) Duration of diabetes did not have significant association with self-care behaviour in this study.

Association of Self-Care Behaviour with Knowledge

Studies in Nigeria and Ethiopia found that the higher the general knowledge of individuals on DM and self-care, the better the self-care behaviour. (20,19) The current study also noted knowledge on diabetes complication and its risk factors significantly associated with better self-care. There was an interesting finding that majority of the respondents unable to identify smoking as a risk factor of diabetes complications. This informs that diabetes health education should highlight the danger of tobacco towards diabetes management. With the advancement of social media, the T2DM patients are exposed to misconceptions and myths in diabetes management which hinder them from practising proper

self-care, thus the patients should be provided with reliable sources to search for accurate diabetes health information.

Association of Self-Care Behaviour with Health Belief

Among the six Health Belief constructs, perceived benefit, cue to action and self-efficacy were significantly associated with better self-care behaviour whilst perceived barrier significantly associated with poorer self-care. Perceived susceptibility and perceived severity are not significantly associate with self-care behaviour. The respondents who had higher perceived benefit noted to have desired self-care behaviour, supported by several studies in Iran and Nigeria which also had the same findings.(16,20,22) Perceived benefit is where the patients believe in the advantage they obtain from taking action to improve their DM, the rewards they gain further motivate them to adopt desired self-care.

Perceived barrier is the obstacle that hinder the patients from practising self-care behaviour, this study found that the higher the barrier, the lower the self-care being adopted. This is parallel with the studies in Iran that showed perceived barrier associated with poorer self-care activities.(16,22,40). Ayele et al. noticed those moderately perceived barrier were 0.3 times less likely to adopt self-care as compared to those less perceived barrier.(17) Among the barriers in self-care are difficulties dealing with complicated management regime, financial constraints for SMBG, afraid that has to deal with diabetes for the rest of the life, social isolation, unsupportive lifestyle choices and lack of emotional support from health care providers.(41,42)

Cue to action is factor which can be a person, an object or an event that motivates the diabetes individual towards desired self-care behaviour. The respondents with higher cue to action had significant better self-care behaviour. Study conducted in Taiwan found that cue to action significantly motivated peripheral neuropathy patients in practising daily foot examination.(43) Similarly in United States, by using text-message as cue to action, the self-care improved significantly.(44) Vazini and Barati revealed that educational level and family history of DM significantly influent cue to action. (40)

Self-efficacy which is the individual's belief in his ability to accomplish a task, was significantly associated with better self-care behaviour adoption in this study. The same findings also noted in studies in Iran.(15,16,22,40) Self-efficacy was positively correlated with duration of diabetes and educational level.(12) In this study, the self-efficacy of the respondents was lowest in SMBG and the adoption of SMBG also noted to be lowest among all the self-care aspects, this further supported the correlation of low self-efficacy was associated with low self-care behaviour. However, other factor such as financial constraint in buying the glucose test strip will also contribute to the low adoption of SMBG.

Predictor of Self-care Behaviour

By using hierarchical multiple regression analysis, self-efficacy, knowledge and female gender were found to be the positive predictor for desired self-care behaviour. In contra, combination therapy of OHA and insulin, monthly income <RM1000 were the predictor of poorer self-care behaviour. All the variances above significantly predicted 14.9% of the total variance in self-care behaviour.

Self-efficacy was identified as the strongest predictor in self-care behaviour. Few studies in Iran also found that self-efficacy was the strongest predictor among the Health Belief Model in predicting self-care behaviour. (15,16,22) In other studies conducted in Iran and Marshall Islands that did not use Health Belief Model, self-efficacy was still the most influence predictor of diabetes self-care.(12,45) Another predictor was knowledge where higher knowledge predicted better self-care behaviour. The same finding also noted in studies conducted in Bangladesh and Iran which identified knowledge as a significant predictor of self-care behaviour.(46,47)

Implication of Study, Recommendations

Based on the findings in this study and further supported by other studies which identify self-efficacy and knowledge as the predictor of desired self-care behaviour, focus should be emphasized on strategies to improve self-efficacy among the T2DM patients in planning future diabetes health intervention. Furthermore, structured health education is vital to be carried out and reached all the T2DM patients to increase their knowledge on DM. Future studies can be conducted on predictor of self-efficacy, and other factors that play a role in determining self-care behaviour such as social support and health literacy. A qualitative study can be conducted to explore the barriers and facilitators of desired self-care behaviour in depth.

Strength and Limitation

By using the Health Belief Model to identify the predictors of self-care behaviour, various facilitating factors and barriers of self-care behaviour were analysed in a structured manner. The study subjected to recall bias especially SDSCA section which required the respondents to recall their self-care practices for the past one week. The findings of this study are unable to generalise to other T2DM population as it only conducted in four government health clinics located in a district of Northern Peninsular Malaysia. The cause and effect are unable to be determined due to the cross-sectional study design.

CONCLUSION

In conclusion, there is still room of improvement in self-care behaviour among this study population. Self-efficacy, knowledge and female gender were identified to be the positive predictor for desired self-care behaviour whilst combination therapy of OHA and insulin, monthly income <RM1000 predicted poorer self-care behaviour. Special attention needs to be paid on specific groups with predicted low self-care behaviour in future planning and implementation of diabetes health intervention.

ACKNOWLEDGEMENT

The authors would like to thank the Director of Health Malaysia for permission to publish this paper, Dr. Tan Ming Yeong and Madam Siti Khuzaimah Ahmad Sharoni who shared their questionnaires. Special thanks to the involved health staffs for their support and contribution to the study.

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