ORIGINAL ARTICLE

Factors associated with medication adherence among type 2 Diabetes patients in a private clinic in Yangon, Myanmar

Wai Yan Maung Maung[1], Sariyamon Tiraphat[2] and Apa Puckpinyo[2]

[1] M.P.H.M. ASEAN Institute for Health Development, Mahidol University, Thailand
[2] Ph.D. ASEAN Institute for Health Development, Mahidol Universty, Thailand

Corresponding Author: Sariyamon Tiraphat   Email: sariyamon.tir@mahidol.ac.th

Abstract

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This cross-sectional quantitative research was designed to determine the proportion of adherence to oral hypoglycemic agents (OHAs) and to explore factors associated with medication adherence among type 2 diabetes patients in a private clinic in Yangon, Myanmar. A total of 396 type 2 diabetes patients were face to face interviewed between April and May 2016. Chi-square test and multiple logistic regression were used to analyze the data.

More than half (65.9%) of the patients were reported as good adherence to oral-hypoglycemic agents. The result showed that significant predictors associated with medication adherence included household income, number of under 12 children, knowledge on diabetes, perceived susceptibility, perceived severity, perceived benefits, perceived barriers, self-efficacy, family support and cues to action. In multiple logistic regression, significant predictors associated with adherence to oral hypoglycemic agents (OHAs) include high level of diabetes knowledge (Adj OR = 3.55, 95% CI = 1.89 – 6.66), positive perceived susceptibility to diabetes complications (Adj OR = 2.08, 95% CI = 1.08 – 4.00), positive perceived severity of diabetes mellitus (Adj OR = 2.54, 95% CI = 1.30 – 4.93), positive perception on barriers (Adj OR = 2.73, 95% CI = 1.50 – 4.97) and high level of self-efficacy (Adj OR = 4.14, 95% CI = 1.99 – 8.61).

The result of this study indicated that health education and health promotion programs should be promoted in order to expand the knowledge of diabetes and life-style modifications.

Keywords: adherence, type 2 Diabetes, Health Belief Model, private clinic, Myanmar

ปัจจัยที่มีความสัมพันธ์กับความร่วมมือในการใช้ยาของผู้ป่วยเบาหวานชนิดที่ 2 ในคลินิกเอกชนพม่า

ไว ยัน เมือง เมือง[1] ศริยามน ติรพัฒน์[2] และ อาภา ภัคภิญโญ[2]

[1] M.P.H.M. สถาบันพัฒนาสุขภาพอาเซียน มหาวิทยาลัยมหิดล ประเทศไทย
[2] Ph.D. สถาบันพัฒนาสุขภาพอาเซียน มหาวิทยาลัยมหิดล ประเทศไทย

บทคัดย่อ

ไว ยัน เมือง เมือง ศริยามน ติรพัฒน์ และ อาภา ภัคภิญโญ
ปัจจัยที่มีความสัมพันธ์กับความร่วมมือในการใช้ยาของผู้ป่วยเบาหวานชนิดที่ 2 ในคลินิกเอกชนพม่า
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การวิจัยแบบภาคตัดขวางเชิงปริมาณในครั้งนี้มีเป้าหมายเพื่อหาสัดส่วนของความร่วมมือในการกินยาเม็ดลดระดับน้ำตาลในเลือด และเพื่อสำรวจปัจจัยที่มีความสัมพันธ์กับการรับประทานยาอย่างสม่ำเสมอสำหรับผู้ป่วยเบาหวานชนิดที่ 2 ที่คลินิกเอกชนในเมืองย่างกุ้ง ประเทศพม่า จำนวนผู้ป่วยทั้งหมดรวม 396 ราย ได้รับการสัมภาษณ์ระหว่างเดือนเมษายน ถึง พฤษภาคม 2559 การวิเคราะห์ข้อมูลใช้การทดสอบไคสแควร์ และการถดถอยโลจิสติกพหุคูณ

มากกว่าครึ่งหนึ่ง (65.9%) ของผู้ป่วยรายงานว่าให้ความร่วมมือในการกินยาเม็ดลดระดับน้ำตาลในเลือด ผลการศึกษาพบว่าปัจจัยที่มีความสัมพันธ์กับการรับประทานยาอย่างสม่ำเสมอ ได้แก่ รายได้ของครัวเรือน จำนวนของบุตรที่มีอายุต่ำกว่า 12 ปี ความรู้เกี่ยวกับโรคเบาหวาน การรับรู้ต่อโอกาสเสี่ยงของการเกิดโรค การรับรู้ความรุนแรงของโรค การรับรู้ประโยชน์ การรับรู้อุปสรรค การตระหนักในความสามารถตนเอง การสนับสนุนจากครอบครัว และ สิ่งชักนำให้เกิดการปฏิบัติ การถดถอยโลจิสติกพหุคูณทำนายว่าปัจจัยที่มีผลต่อความร่วมมือในการกินยาเม็ดลดระดับน้ำตาลในเลือด ประกอบด้วย ผู้ป่วยที่มีความรู้เกี่ยวกับโรคเบาหวานในระดับที่สูง (Adj OR = 3.55, 95% CI = 1.89-6.66) ผู้ป่วยที่มีการรับรู้ต่อโอกาสเสี่ยงของการเกิดโรคในระดับที่สูง (Adj OR = 2.08, 95% CI = 1.08-4.00) ผู้ป่วยที่มีการรับรู้ความรุนแรงของโรคเบาหวานในระดับที่สูง (Adj OR = 2.54, 95% CI = 1.30-4.93) ผู้ป่วยที่มีการรับรู้ในเชิงบวกต่ออุปสรรคของโรค (Adj OR = 2.73, 95% CI = 1.50-4.97) และผู้ป่วยที่รับรู้ความสามารถของตนเองในระดับที่สูง (Adj OR = 4.14, 95% CI = 1.99-8.61)

ผลการศึกษาครั้งนี้ชี้ให้เห็นว่าการให้ความรู้ด้านสุขศึกษาและการส่งเสริมสุขภาพควรจะได้รับการส่งเสริมเพื่อที่จะขยายความรู้เกี่ยวกับโรคเบาหวานและการปรับเปลี่ยนวิถีการดำเนินชีวิต

คำสำคัญ: ความร่วมมือในการกินยา ผู้ป่วยเบาหวานชนิดที่ 2 แบบแผนความเชื่อด้านสุขภาพ คลินิกเอกชน ประเทศพม่า

Introduction

Diabetes Mellitus is a kind of metabolic disease due to defect in insulin secretion, insulin action or both [1]. There are two types of diabetes mellitus Type 1 (Insulin Dependent Diabetes Mellitus or IDDM) and Type 2 (Non-insulin Dependent Diabetes Mellitus or NIDDM). The occurrence of type 2 diabetes mellitus is about 90% of all diagnosed diabetes patients [2-3]. If the diabetes is not well controlled, the complications will occur. There are two types of complications (i) Acute complications such as Diabetes Ketoacidosis (DKA), Lactic Acidosis (LA) and Hyperosmolar Nonketotic Coma (HNC), hypoglycemia or hyper-glycemia (ii) Chronic complications include micro-vascular complications (coronary artery disease, peripheral artery disease and stroke) and macro-vascular complications (diabetes neuropathy, nephropathy and retinopathy) [4].

World Health Organization (WHO) estimated that there were 171 million people with diabetes around the world in 2000 and the prevalence will increase to 366 million in 2030 [5]. International Diabetes Federation estimates that there were 381.8 million of people with diabetes around the world in 2013 and it will increase to 591.9 million in 2035. There were 72.1 million of diabetes patients in 2013 and it tends to rise to 123 million in 2035 in South-East Asia [6].The prevalence and death become significantly increase in South East Asia Region (SEAR), estimated about 0.3 million death during 2008 in male more than female [7]. Growing fast of the development of South-East Asia lead to increase the prevalence of diabetes rapidly, it is nearly one fifth of all diabetes cases all over the world [6].

Data from National Prevalence of Diabetes and Pre-diabetes in Myanmar, which was conducted in 2014, the adult diabetes prevalence was 10.5% which is higher than those of many Asian countries such as Sri Lanka (8.8%), Thailand (6.7%), Bangladesh (5.5%) and Nepal (4.5%) respectively. Among them, the adult prevalence rate of diabetes mellitus in Yangon region increased from 12% in 2013 to 18% in 2014 [8].

The prevalence of diabetes and its burden is increasing all over the world. Medication adherence and life-styles modifications are important options that can prevent the diabetes progress into diabetes related complications [9]. At first, the term "Compliance" was used in literatures to describe the medication dosing [10]. Later, the World Health Organization (WHO) has promoted this term into "Adherence" for use in chronic disorder [11]. Medication adherence is stated as the extent to which the patients can follow upon the instructions of regimen by the health care personals [12]. Adherence of OHAs on diabetes patients (both type 1 and type 2) varied from 36% to 93% by reviewing the retrospective studies [13-18], in some prospective studies, adherence ranged from 61% to 85% during up to 6 months of observation period [19-23]. The average adherence rate only on type 2 diabetes mellitus ranged from 12% to 99% [24-28]. Huge variations occurred from one study to another because of difference focusing on types of therapy (i.e. mono-therapy or combination therapy) and difference in study durations and methods.

Although the prevalence and burden of diabetes mellitus is also increasing in Myanmar, the prevalence of medication adherence among type 2 diabetes patients is unknown. The purpose of this study is (1) to determine the proportion of diabetes patients having good adherence to oral hypoglycemic

agent medication (2) to identify the factors related to the adherence to oral hypoglycemic medication using quantitative study method in a private clinic. Understanding of factors associated with medication adherence among type 2 diabetes patients can notify public health for the patients' life-style modifications leading to decreasing of the disease burden nationally.

Methods

There were total 396 (including 10% topped up for missing data) patients of type 2 diabetes mellitus patients who came to consult with specialist in a specialist private clinic were recruited.

There are 4 famous diabetes specialize private clinics are taking care of most of diabetes patients in Yangon. Among 4 clinics, one was randomly selected. For type 2 diabetes patients, samples were selected purposively. To avoid the selection bias and duplications, the inclusion and exclusion criteria were explained to physician before conducting the research. After that, the physician chose proper samples by labeling on the patients' medical record books.

The data collection period was from 1st April 2016 to 28th May 2016. The clinic opens from 3pm to 11pm, 4 days a week (i.e. Monday, Wednesday, Friday and Saturday). The inclusion criteria were (1) patients of 30 years and above (the age was set after reviewing the patients' registration records and found that most of the type 2 diabetes patients are more than 30 years) (2) patients diagnosed with type 2 diabetes mellitus at least six months duration with or without co-morbidity (3) patients with oral hypoglycemic medication at least six months duration. The exclusion criteria were (1) patients who are too sick to participate in the study (2) patients who have cognitive impairment (3) Patients who are taking insulin medication.

The data were collected by face-to-face interviewed method by using structured questionnaires. The researcher interviewed all the participants. The proposal was approved by the ethic committee of Mahidol University (Code of Approval No: MU-SSIRB 2016/116.2903).

The questionnaires contained 7 sections. Section 1 was the questions for socio-demographic characteristics. Section 2 was about diabetes knowledge that was taken from a set of diabetes knowledge questionnaires[29]. The adherence section was measured by Morisky Medication Adherence 8 item (MMAS-8) scale, which has high validity and reliability to measure the adherence. There are 8 questions in total, 7 "Yes" or "No" questions and one multiple-choice question. The total score of 0 to 6 means low adherence and 7 to 8 means high adherence[30-31]. The perception section was developed based upon the Illness Perception Questionnaire (IPQ) which was validated in previous studies[32]. It was subdivided into (i) perceived susceptibility (ii) perceived severity (iii) perceived benefits and (iv)perceived barriers; there were 5 items in each sub section. The self-efficacy section was developed from "New General Self efficacy scale (NGSE)". The family support and cues to action sections were developed from previous studies, research objective, theoretical and conceptual framework. The perception, self-efficacy, family support and cues to action sections were measured by using three point Likert scale (i.e. Agree, Uncertain and Disagree).

For the validity, it was conducted with expert persons in Mahidol University and also experts from the related fields in Myanmar. The questionnaires were

translated into Myanmar version under supervision of local experts in Myanmar. The reliability of the questionnaires was measured by conducting pre-test among 36 subjects before actual data collection. The Cronbach Alpha for the testing questionnaires was set to be at least 0.7. The questions that effect the reliability were removed after pilot testing.

For the reliability, Cronbach Alpha of: adherence session was 0.84, perceived susceptibility was 0.72, perceived severity was 0.72, perceived benefit was 0.86, perceived barrier was 0.75, self-efficacy was 0.89, family support was 0.87 and cues to action was 0.79, and the KR-20 of the knowledge part knowledge session was 0.84,respectively.

Descriptive statistics was used to describe the socio-demographic characteristics, knowledge, perceptions, family support, self-efficacy, cues to action, medication adherence in terms of mean, median, standard deviation and proportion. For the association of independent and dependent categorical variables, the Pearson Chi-square test was used. Then, the significant factors from the chi-square were included in the multiple logistics regression to examine the adjusted odd ratios.

Results

The socio-demographic features of 396 type 2 diabetes patients are shown in Table 1. The majority of the patients were female (69.7%), married (73.5%) and most of them had secondary school or high education (59.3%). 38.2% had their own business meanwhile 41.9% are dependent. The distribution is harmonious between three groups of income (i.e. around 30%), majority of them had at least 4 family members (69.4%), whereas no children who are under 12 years (75.8%) in households. Most of the patients were diagnosed and suffering type 2 diabetes mellitus since 5 years ago; among them, 62.1% were start-taking OHA when they were first diagnosed. In the study, 54.8% of the patients had co-morbid diseases (Cardiovascular diseases, Hypertension, Kidney diseases and others) along with type 2 diabetes mellitus.

Table 1 Distribution of respondents by general characteristics of type 2 Diabetes Mellitus patients

	Number (%)
Age group (Years)	
30-45	64 (16.2)
46-60	208 (52.5)
>60	124 (31.3)
Mean (SD)= 55.8 (10.1)	
Gender	
Male	120 (30.3)
Female	276 (69.7)
Marital status	
Single	62 (15.7)
Married	291 (73.5)
Divorced, Separated, Widow	43 (10.9)
Education	
Primary school or lower education	66 (16.7)
Secondary school or high education	235 (59.3)
College/Bachelor or higher degree	95 (24)
Occupation	
Government	18 (4.5)
Non-Government	61 (15.4)
Own Business	151 (38.2)
Dependent	166 (41.9)
Household income (kyats per month)	
Low (≤300000)	134 (33.8)
Middle (300001-599999)	125 (31.6)
High (≥600000)	137 (34.6)
Mean (SD)= 666565 (910196)	
Number of family members in household	
<4	121 (30.6)
≥4	275 (69.4)
Number of children under 12 years in household	
0	300 (75.8)
1-5	96 (24.2)
Duration of diagnosis	
<5 years	239 (60.4)
5 - 10 years	85 (21.5)
> 10 years	72 (18.1)
Duration of taking OHA	
<5 years	246 (62.1)
5 - 10 years	80 (20.2)
> 10 years	70 (17.7)
Co-morbidity	
Yes	217 (54.8)
No	179 (45.2)

Out of 396 patients, 163(41.2%) had good level of knowledge upon diabetes and its consequences, 223(56.3%)

had positive perception on susceptibility and 253 (63.9%) had positive perception on severity of the disease and its related complications. Moreover, 320(80.8%) had perceived positively on the benefits of taking medicines and 212(53.5%) patients had positive perception on barriers to take medicine and follow-up regularly. Meanwhile, 302(76.3%) patients had high self-efficacy, 325(82.1%) had got support from their family members and 290(73.2%) patients had high cues to action as shown in Table 2. The positive and negative categories were divided by using median score in each session.

Table 2. Description on knowledge, perceptions, self-efficacy, family support and cues to action level of participants

Item	Mean (SD)	Positive/Good Number (%)	Negative/Poor Number (%)
Knowledge	5.8 (1.8)	163 (41.2)	233 (58.8)
Perceived susceptibility	13.8 (1.6)	223 (56.3)	173 (43.7)
Perceived severity	12.8 (0.4)	253 (63.9)	143 (36.1)
Perceived benefits	14.6 (0.7)	320 (80.8)	76 (19.2)
Perceived barriers	13.3 (2.1)	212 (53.5)	183 (46.5)
Self-efficacy	20.5 (1.1)	302 (76.3)	94 (23.7)
Family support	17.2 (2.1)	325 (82.1)	71 (17.9)
Cues to action	3.8 (0.9)	290 (73.2)	106 (26.8)

The distribution of adherence to Oral Hypoglycemic Medication is as shown in Table 3 with 95% of confidence interval. Out of 396 patients, there were 132 patients who sometimes forgot to take medicine, whereas only 47 patients missed their pills in last 2 weeks. Most of the patients (96%) were not stopped taking medicine when they felt worse. 363 patients usually brought their medicine along with them when they travelled or left home. Almost all the patients were not forgot to take their pills in yesterday; and most of the patients were not stopped taking pill when diabetes is under control. 96% of the patients did not feel hassled about sticking to treatment plan. After examined how often the patients forgot to take their pills, it showed 262 patients (66.2%) never forgot whereas 134 patients (33.8%) forgot once in a while or usually or all the times.

Good adherence (score 7 and 8) and Poor adherence (score 6 and below) were classified based on the total score. Out of 396 patients, 65.9% were good adherence whereas 34.1% were poor adherence to oral hypoglycemic medication.

Table 3   Adherence to oral Hypoglycemic medication (MMAS-8) (n=396)

	Yes	No
	Number (%)	Number (%)
Sometime forgot to take OHA	132 (33.3)	264 (66.7)
Miss pill in last 2 weeks	47 (11.9)	349 (88.1)
Stop taking medicine when felt worse	15 (3.8)	381 (96.2)
Forget to bring medicine when travel	33 (8.3)	363 (91.7)
Take yesterday pill	382 (96.5)	14 (3.5)
Stop pill when disease under control	19 (4.8)	377 (95.2)
Hassled about sticking treatment plan	16 (4.0)	380 (96.0)
Forget once in a while, usually, all the time	134 (33.8)	262 (66.2)
Good adherence	261 (65.9)	135 (34.1)

Table 4 shows the association between socio-demographic characteristics and adherence to OHA. The Chi-square test showed that household income and under 12 children were significantly associated with medication adherence. Analysis by simple logistic regression showed that the patients with low income (≤300000) were less likely to have good adherence to OHA (Crude OR = 0.51, 95% CI = 0.30 - 0.85). The simple logistics regression also showed the families which have no under 12 children were more likely to have good adherence to OHA (Crude OR = 1.83, 95% CI = 1.14 - 2.93). The remaining variables such as age, gender, marital status, education, occupation, number of family member, duration of diagnosed DM, duration of taking OHA, co-morbid disease were not statistically significantly with adherence to OHA (p-value > 0.05).

Table 4   Association between socio-demographic characteristics and adherence to OHA

	Adherence to OHA		p-value
	Good	**Poor**	
	Number (%)	**Number (%)**	
Age group (Years)			
30-45	39 (60.9%)	25 (39.1)	0.424
46-60	143 (68.8)	65 (31.3%)	0.71
>60	79 (63.7)	45 (36.3)	0.346
Gender			
Male	84 (70)	36 (30)	0.257
Female	177 (64.1)	99 (35.9)	0.258
Marital status			
Single	43 (69.4)	19 (30.6)	0.823
Married	190 (65.3)	101 (34.7)	0.648
Divorced, Separated, Widow	28 (65.1)	15 (34.9)	0.982
Education			
Primary school or lower education	38 (57.6)	28 (42.4)	0.264
Secondary school or high education	157 (66.8)	78 (33.2)	0.122
College/Bachelor or higher degree	66 (69.5)	29 (30.5)	0.64
Occupation			
Government	11 (61.1)	7 (38.9)	0.133
Non-government	46 (75.4)	15 (24.6)	0.943
Own business	104 (68.9)	47 (31.1)	0.036
Dependent	100 (60.2)	66 (39.8)	0.11
Household income (Kyats)			
Low (≤300000)	78 (58.2)	56 (41.8)	**0.037**
Middle (300001 - 599999)	83 (66.4)	42 (33.6)	**0.011**
High (≥600000)	100 (73)	37 (27)	0.246
Number of family member			
<4	76 (62.8)	45 (37.2)	0.388
≥4	185 (67.3)	90 (32.7)	0.388
Number of under 12 children			
0	208 (69.3)	92 (30.7)	**0.011**
1-5	53 (55.2)	43 (44.8)	**0.012**
Duration of DM diagnosed (Years)			
<5	159 (66.5)	80 (33.5)	0.421
5-10	59 (69.4)	26 (30.6)	0.29
>10	43 (59.7)	29 (40.3)	0.206
Duration of taking OHA (Years)			
<5	163 (66.3)	83 (33.7)	0.629
5-10	55 (68.8)	25 (31.3)	0.454
>10	43 (61.4)	27 (38.6)	0.348
Comorbidity			
Not Have	120 (67)	59 (33.0)	0.667
Have	141 (65)	76 (35.0)	0.667

Table 5 shows the association between knowledge, perception, self-efficacy, family support and cues to action with adherence to OHA treatment.

In this study, as shown in Table 5; levels of knowledge, perception on susceptibility of complications, perception on severity of diabetes and its related complications, perception on benefits of medication, perception on barriers to medication, self-efficacy, family support and cues to actions had statistically significant association with adherence on OHA (p-value < 0.05).

Table 5   Association between knowledge, perception, self-efficacy, family support and cues to action with adherence to OHA treatment

	Adherence to OHA		p-value
	Good	Poor	
	Number (%)	Number (%)	
Knowledge levels			**<0.001**
Good	141 (86.5)	22 (13.5)	**<0.001**
Poor	120 (51.5)	113 (48.5)	
Perceived susceptibility			**<0.001**
Positive	188 (84.3)	35 (15.7)	**<0.001**
Negative	73 (42.2)	100 (57.8)	
Perceived severity			**<0.001**
Positive	209 (82.6)	44 (17.4)	**<0.001**
Negative	52 (36.4)	91 (63.6)	
Perceived benefits			**<0.001**
Positive	241 (75.3)	79 (24.7)	**<0.001**
Negative	20 (26.3)	56 (73.7)	
Perceived barriers			**<0.001**
Positive	181 (85.4)	31 (14.6)	**<0.001**
Negative	80 (43.5)	104 (56.5)	
Self-efficacy levels			**<0.001**
High	242 (80.1)	60 (19.9)	**<0.001**
Low	19 (20.2)	75 (79.8)	
Family support levels			**0.001**
Good	226 (69.5)	99 (30.5)	**0.001**
Low	35 (49.3)	36 (50.7)	
Levels of cues to Action			**0.018**
High	201 (69.3)	89 (30.7)	**0.019**
Low	60 (56.6)	46 (43.4)	

Table 6 shows final model of multiple logistic regression, for knowledge, patients with good knowledge level were more likely to adhere to OHA (Adj OR = 3.55, 95% CI = 1.89 – 6.66). Regarding to perceived susceptibility, patients who perceived they are susceptible to complications were more likely to adhere to OHA treatment (Adj OR= 2.08, 95% CI = 1.08 – 4.00). For perceived severity of diabetes, the patients who perceived diabetes is severe were more likely to have better adherence to OHA (Adj OR = 2.54, 95% CI = 1.30 – 4.93). Patients who had positive perception on barriers were more likely to have better adherence on OHA (Adj OR = 2.73, 95% CI = 1.50 – 4.97). As regards to self-efficacy of the patients, who had high level of self-efficacy were better adherence to OHA (Adj OR = 4.14, 95% CI = 1.99 – 8.61).

Table 6 Final model of multiple logistic regression for predictors of adherence to OHA treatment

	Crude OR(95% CI)	Adjusted OR (95%CI)	p-value
Household income (Kyats)			
Low (≤300000)	0.51 (0.30 - 0.85)	0.94 (0.46 - 1.90)	0.865
Middle (300001 - 599999)	0.73 (0.43 - 1.24)	0.99 (0.48 - 2.05)	0.992
High (≥600000)	1	1	
Number of under 12 children			
0	1.83 (1.14 - 2.93)	1.65 (0.86 - 3.18)	0.129
1-5	1	1	
Knowledge levels			
Good	6.03 (3.59 - 10.12)	3.55 (1.89 - 6.66)	**<0.001**
Poor	1	1	
Perceived susceptibility			
Positive	7.35 (4.59 - 11.77)	2.08 (1.08 - 4.00)	**0.027**
Negative	1	1	
Perceived severity			
Positive	8.31 (5.19 - 13.31)	2.54 (1.30 - 4.93)	**0.006**
Negative	1	1	
Perceived benefits			
Positive	8.54 (4.82 - 15.10)	1.84 (0.82 - 4.16)	0.138
Negative	1	1	
Perceived barriers			
Positive	7.59 (4.69 - 12.26)	2.73 (1.50 - 4.97)	**0.001**
Negative	1	1	
Self-efficacy levels			
High	15.92 (8.93 - 28.36)	4.14 (1.99 - 8.61)	**<0.001**
Low	1	1	
Family support levels			
Good Level	2.34 (1.39 - 3.95)	0.57 (0.26 - 1.24)	0.159
Low Level	1	1	
Levels of cues to action			
High	1.73 (1.09 - 2.73)	1.46 (0.78 - 2.72)	0.232
Low	1	1	

Discussion

Since treatment adherence to OHA is a well-established method to reduce the occurrence of diabetes complications, it is reasonable to believe that the poor adherence will prone to complications. Identification of prevalence and the risk factors of medication adherence could facilitate measures to improve adherence and subsequent control.

Prevalence of adherence in previous studies varied by location. Regarding the results in this study, the prevalence of OHA adherence in type 2 diabetes patients was 66% which was measured by previously validated Morisky Medication Adherence 8 items scale (MMAS-8). Analyzing the database of Medi-Cal program on Medicaid population of US showed the adherence rate of OHA in type 2 diabetes patients was 43% in one year cohort and 37% in two-year cohort study[24]. A retrospective study by analyzing the database from a national pharmacy benefit manager organization highlighted that the mean adherence rate of OHA on once daily regimen was 60.5% and twice daily regimen was 52% in type 2 diabetes patients[25]. A study conducted on Tayside population of Scotland by using the resources of the DARTS (Diabetes Audit and Research in Tayside)/MEMO Collaboration indicated that over all adherence rate for sulphonylureas was 93% and 85% for metformin in type 2 diabetes patients[26]. According to the study upon type-2 diabetes in Southwest Germany, it revealed that approximately 78% were adhered to anti-diabetes medication where adherence rate was measured by Morisky Medication Adherence 4 items scale (MMAS-4)[33]. A study done in Nader Kazemi Clini in Shiraz by using Medication Adherence Report Scale (MARS) reported the majority of participants (87%) adhered to their medication[34]. A cross sectional survey within six month period in seven Ministry of Health Primary Health clinics in Hulu Langat, Selangor, Malaysia by using developed questionnaires by using Morisky self-reporting scale, Hill-Bone Compliance to High Blood Pressure Therapy Scale and MMAS showed the adherence rate was 47%[35]. A systematic review of medication adherence in both developed and developing countries showed the average adherence rate ranged from 36% to 93%[36]. One of the reasons for large variation in findings in these studies could be different method for measuring adherence, different focus on types of OHA, duration and type of study. It is also possible that the adherence behavior changes based upon the different population and cultural settings[36-37].

In socio-demographic characteristics, some of the variables (household income, number of under 12 children) were significantly associated with medication adherence whereas other variables like (age, marital status, gender, education, income, occupation, family income, number of family members, duration of diabetes, co-morbidity) were not associated with medication adherence. Some findings were consistent with previous literatures[12, 38-43] although some were not[9, 34, 44, 45]. Possible reasons of variations may be different socio-economic background and cultural diversities.

Regarding to knowledge session, there were only 41.2% of the patients can be assumed as good knowledge and the remaining 58.8% had poor knowledge upon diabetes. Among the good knowledge group, 86.5% were adhere to treatment, whereas there were only half of the patients (50%) were adhere to treatment in poor knowledge group. It may be possible

that good knowledge will lead to positive perception and motivation for medication adherence. Despite, in this study, the final model showed there is no association between knowledge and medication adherence where it is inconsistent with previous studies[35, 39.]

Under perception session; exception for perceived benefits, perceived susceptibility, perceived severity and perceived barriers were predictors of medication adherence. These results are consistent with previous studies[34, 38, 42, 46-48]

The patients who believed that they are susceptible to complications and disease if they don't take medicine regularly were adhere to treatment. It is also important to have the positive faith upon their daily medicine and self-motivation to overcome the barriers in order to adhere to regimens.

For the chronic disease like Hypertension and diabetes, it is important to have self-efficacy for their long-term treatment plan. Their self-care activities will achieve the good outcome and also can promote the involvement of family members. Our result is consistent with the previous study[42, 49-50], the final model showed the self-efficacy was significantly associated with medication adherence in this study (p-value < 0.001).

With increasing medication cost and life long-term therapy for diabetes, the affluent families may cover the cost but the poor may need the contribution from the family members. However, our result showed that there was no significant association between family support and medication adherence where it is inconsistent with previous studies[43, 51-53].

Regarding cue to action and the medication adherence, it is reasonable to believe that the ones who had the information about their diseases and were activated or stimulated from the environment, families, doctors, relatives and social media will be more likely to have knowledge and know how to cope with their disease, how to control their self-care behaviors which will automatically led them to achieve their quality of life. However, cues to action was not a significant predictor of medication adherence in our study. It is inconsistent with previous findings[52, 54-55].

Recommendation

Policy Maker Recommendation

Diabetes Mellitus is a chronic non-communicable disease, which requires long-term treatment with regular follow-up and investigations in order to detect the complications ahead. As a chronic disease, the only options are life-style modification and control with medicines.

In this study, more than half (58.8%) patients seem to be poor knowledge upon diabetes mellitus; therefore, conducting health-education and health promotion sessions will expand the patients' knowledge upon their disease and increase awareness on it. In the study, some patients came from the far distance like another city or district for follow-up, one of the reason may be there were no healthcare providers that can treat their disease effectively and efficiently. Producing more healthcare personals, conducting refresher training and capacity building to healthcare providers or personnel will be one of the solutions. Some patients explained that their main cause of non-adherence to medication was the medication cost is high; therefore, effective implementatioin of public insurance system by the government will be a helping hand for those who couldn't afford to pay. Nowadays, there are increasing number of vehicles

and traffic problems everywhere; therefore patients couldn't follow up regularly due to the difficulties of transportation. There should be some good public transport system to reduce number of private vehicles and effective traffic control system to overcome this barrier in order to get regular follow up and treatment adherence. The last recommendation is to create healthier environment like creating bicycle lanes, sport pitches and public outdoor gyms for promoting physical activities in order that patient can access easily by the public for life-style modification.

Recommendation on future research

This study was conducted in one private clinic in Yangon, Myanmar. The information obtained from this study cannot be generalized because patients who came to private clinic can be regarded as wealthy and there are still many diabetes patients who can't afford to come to private clinics and are taking medicine care in their respective local government hospitals or clinics. So, this study would be starting point of studying adherence of diabetes in the country Myanmar. Future study should be preceding base upon the community from the government hospitals or local clinics. Additionally, this study was emphasized on type 2 diabetes only; therefore study on type 1 diabetes should be considered.

In addition, this study method was a quantitative, future research should be qualitative research which can explore the reasons for adherence and non-adherence more and deeply. This study emphasize upon treatment with Oral Hypoglycemic Agent (OHA) only, so next research will be done upon insulin medication only or both OHA and insulin. The researchers can also study upon the patients-providers relationship,

healthcare system for non-communicable disease and financial system.

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