Association between General Characteristics, Knowledge and Patient Activation among Patients with Type 2 Diabetes in Myanmar

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ABSTRACT

The objectives of the study were to determine the level of diabetes knowledge and patient activation among patients with diabetes and to identify demographic, clinical and psychosocial factors involved in patient activation. A clinical-based cross-sectional study was conducted among patients with type 2 diabetes attending a diabetes specialist clinic in Yangon, Myanmar. In total, 250 participants gave written consent to participate in this study. To determine the level of knowledge and patient activation, face-to-face interviews were conducted using Patient Activation Measure (PAM) and Diabetes Knowledge Test (DKT) questionnaires. The mean score of PAM was 60.6 ± 13.6 and mean DKT score was 14.6 ± 4.6. Male patients had higher activation than females (OR=3.04, 95% CI= 1.23-7.54, *p*=0.016). Smoking status and alcohol consumption were associated with PAM (OR=4.25, 95% CI=1.48-12.2, *p*=0.007) and a high level of patient activation (OR=5.42, 95% CI=1.66-17.7, *p*=0.005) respectively. High diabetes knowledge was significantly associated with high activation level (OR=16.6, 95% CI=5.91-46.4, *p*<0.001). Among patients with type 2 diabetes, patient activation level was especially related to disease-specific knowledge. High activation was significantly associated with sex, smoking status, alcohol consumption and diabetes knowledge. Sociodemographic and clinical characteristics, such as marital status, education level, occupational status, BMI and HbA1c had no influence on patient activation. Based on the results, many elderly patients with diabetes need to have more knowledge on diabetes and actively participate in controlling the disease.

Keywords: Type 2 diabetes; Patient characteristics; Diabetes knowledge; Patient activation

THJPH 2020; 50(1): 11-24

Received: July 31, 2019; Revised January 3, 2020; Accepted April 27, 2020

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Introduction

Noncommunicable diseases are a group of diseases that are generally chronic and require lifelong treatment to prevent complications and mortality. During the last 20 years the prevalence of diabetes has increased dramatically in many parts of the world and the disease is now a worldwide public health problem. The world prevalence of diabetes among adults was 6.4% in 2010 and will increase to 7.7% in 2030. Between 2010 and 2030, a 69% increase in developing countries and a 20% increase in developed countries will be observed [1]. The prevalence of diabetes in Myanmar was 5.9% among males, 7.2% among females and totaled 6.6%[2]. According to the International Diabetes Federation, the number of people living with diabetes worldwide is expected to reach 592 million by 2035[3].

In common with other low-income countries, Myanmar is currently facing the double burden of communicable and non-communicable diseases. Type 2 diabetes is the most common type of diabetes and accounts for ~90–95% of all reported cases of diabetes mellitus. The great increase in the prevalence of diabetes is due to epidemiological transitions such as sedentary life style and unhealthy food[4-6]. These factors include obesity, excess fat around the waist, increased consumption of sugary food and drinks and individual lifestyles.

To manage the scourge of diabetes, public health interventions are necessary to avert diabetes. Such initiatives can include comprehensive lifestyle modification for those at risk of diabetes and timely treatment for those with the disease. An aggressive approach targeting individuals at risk of diabetes is an essential public health approach aimed at decreasing the risk factors for diabetes at the community level. A correlation exists between individuals with lower levels of health knowledge and higher burdens of diabetes. Patients' knowledge of their health can be useful in evaluating the risk for diabetes, treatment, and control of diabetes.

Self-management of diabetes involves considerations and choices that the patient with diabetes must make on a daily basis. It requires that patients are able to reconcile their resources and preferences with the therapeutic regimens of a healthy diet, exercise, no smoking, low alcohol intake, glucose monitoring and medication. Self-management is the individual's ability to manage symptoms, treatment, physical and psychosocial consequences in living with a chronic condition[7]. This is achievable by affording individuals with comprehensive diabetic care including self-management education[8].

The current burden of these chronic diseases reflects cumulative risks over a lifetime. In Myanmar, treatment for diabetes,

cancer, cardiovascular diseases and chronic respiratory diseases is extremely expensive, and the costs involved force families into catastrophic spending and impoverishment. Individuals, families and communities collectively experience the burdens of chronic disease. These burdens include stress, time constraints, daily disruptions, hassles and other strains not easily quantified.

Limited research is available concerning diabetes and other communicable diseases conducted in Myanmar. The rapid epidemiological shift towards communicable diseases is unmatched with change in research priority and funding. Regarding the management of type 2 diabetes in Myanmar, tools to measure the implementation of published guidelines are lacking. For example, clinical auditing of diabetes is not widely implemented to assess the quality of provided care. In addition, scarcity of published studies on quality of diabetes management in Myanmar creates a wide knowledge gap in the field. Due to the results of a review of related literature, no study of Patient Activation Measurement (PAM) has been conducted in Myanmar. Consequently, this research aims to determine the level of knowledge on diabetes among Myanmar people and patient activation level.

Patient activation is a behavioral concept. Patients with the skills, knowledge and motivation to participate as effective self-managers are referred to as activated patients. An increase in knowledge and skills to act correctly concerning informed choices is also interwoven with active participation and increased awareness. PAM also assures that patient activation does not depend on specific medical encounters. In other words, patient activation is a patient characteristic, not a result of prior encounters with doctors. The PAM score measures the knowledge, skills and confidence for managing one's own health and healthcare. It is generally used as a measure of patient activation in managing healthcare and disease status.

Investigating patient activation and health-related outcomes will provide insight into the gains when patients are more involved in their health care. Since the development of PAM, many studies were conducted to assess the validity of the tool[9-11]. Examining the association between patient activation and health use is a topic of interest for health researchers. A positive association between patient activation and self-management behaviors has been reported by various studies[12,13]. Highly activated patients are likely to read about possible side effects, engage in preventative health behaviors and have the ability to obtain needed health care services. The aim of this study was to measure patient activation and its relationship with diabetes knowledge and socio-demographic factors of patients with diabetes.

Materials and Methods

Study design and participants

A clinical-based cross-sectional study was conducted at the diabetes specialist clinic in Yangon, Myanmar. The study measures were obtained from interview questionnaires. Participants were required to meet the following inclusion criteria. Participants had to be 18 to 75 years old, presenting type 2 diabetes, and willing to complete the interview questionnaire during waiting time at the clinic. A convenience sampling technique was used to identify participants for the study. Eligible patients were approached as they waited to see the doctor in the clinic for routine monthly follow up appointments.

Each patient was approached personally for consent to take part in the study. This was done after the nurse in charge of the clinic had made a general announcement about the study to everyone present. A pilot study was conducted in September 2018 with 20 patients to gauge the clarity and flow of the questionnaire. Data were collected starting January 2019 and each patient was asked to sign the consent form after agreeing to participate. After obtaining consent from patients, face-to-face interviews were conducted in a private room of the clinic. In total, 250 patients participated.

Questionnaires

The questionnaires were divided into three sections. Sociodemographic questionnaires were used to collect sociodemographic and clinical characteristics of the participants. Variables such as age, sex, marital status, level of education, occupation, history of smoking and alcohol consumption were collected during interviews and clinical characteristics like drug history and HbA1c were obtained from the patient's record book. Height and weight were measured at the clinic by nurses and the body mass index (BMI) of each participant was calculated using the BMI formula = Weight (kg)/Height (m^2).

The Diabetes Knowledge Test (DKT) questionnaire was developed by the Michigan University Diabetes Research and Training Center[14]. The original questionnaire included 23 items representing diabetes knowledge. Participants were asked questions on knowledge regarding prevention as well as healthy diet and use of insulin. In all, 14 questions were related to general knowledge on diabetes and 9 others to the use of insulin. Each correct answer was scored 1 and wrong answers were scored 0. The knowledge scores ranged from 0-23 and were categorized as follows: 0-10 = poor knowledge, 11-17 = average knowledge and 18-23 = high knowledge level. The translation of the DKT questionnaire was conducted in accordance with the WHO process for translating and adapting instruments[15].

The PAM questionnaire was developed by Dr. Judy Hibbard at the University of Oregon[16]. PAM had already been translated to Burmese by a licensed provider. PAM contains 13 questions. Questions 1 and 2 represent belief has an active role and is important, questions 3 to 9 represent confidence and knowledge to take actions, questions 10 to 12 represent taking actions and question 13 represents staying on course under stress. Each question uses a Likert scale with four possible answers: disagree strongly, disagree, agree and agree strongly. The raw score was converted to an interval scale 0-100.

This score is also reported as one of four corresponding levels. Level 1 "Starting to Take a Role" (score ≤47): Patient does not yet grasp that they must take an active role in their health. Level 2 "Building Knowledge and Confidence" (score ≥47.1 and ≤55.1): Patient lacks the basic facts or has not connected these facts into a larger understanding of their health. Level 3 "Taking Action" (score ≥55.2 and ≤67.0): Patients have the key facts and are beginning to take actions but may still lack confidence. Level 4 "Maintaining Behaviors" (score ≥67.1): Patients have adopted new behaviors but are still working to maintain these under stress or crises.

Statistical analysis

Statistical Package for the Social Sciences SPSS, Version 25, was used for data management and statistical analysis purposes. All statistical tests were performed using a *p*-value of 0.05 as the level of significance. Descriptive analyses were conducted on the demographic variables of age, sex, educational attainment, employment, marital status and other patient characteristics such as BMI, HbA1c, DKT and PAM score at baseline. Mean and standard deviation (SD) were computed for all continuous variables while frequencies and percentages were computed for all categorical variables. Due to the presence of categorical variables, associations were calculated using the chi-square test, bivariate and multivariate logistic regression analysis.

Ethical considerations

To conduct this research, ethical approval was obtained from the ethics board of the International University of Health and Welfare, Japan (IUHW-2017-1484). Permission to conduct this study and extract data from medical records was obtained from the Director of the Diabetes Specialist Clinic in Yangon, Myanmar. Participants were required to give signed informed consent before the interview. The names of the patients were not recorded during the interviews and these documents were kept confidential.

Results

Patients' sociodemographic characteristics and clinical parameters are shown in Table 1. The total number of study respondents was 250. Their mean age was 52.6 ± 10.4 years, and the highest percentage of respondents was aged 51 to 60 years (33.2%). In the current study, 54% of participants were female and 46% male. Most participants were married; only 21.2% were not married. In all, 51.2% reported an education level less than or equal to high school and 48.8% were university graduates. Regarding occupation, the predominant group was retirees (32%) and government officers were the fewest (18.4%). The majority of participants (68.8%) were nonsmokers and 11.6% were ex-smokers. Most participants (66%) did not consume alcohol and 16.4% were ex-drinkers. HbA1c level of the participants was grouped into two categories: lower than 7% and higher than or equal to 7% and mean HbA1c was 7.3 (±1.4). Among the participants, 52.8% were within the normal range (HbA1c <7%) and 47.2% had above or equal to 7% and could not control their HbA1c levels. Regarding medication status, 92.4% of the participants were taking oral antidiabetics only, 5.2% were taking oral antidiabetic with insulin, and 2.4% were taking insulin only. Mean (SD) DKT score was 14.6 (± 4.65); 47.6% of participants had an average knowledge level, 23.2% had a poor level of knowledge, and 29.2% had a high knowledge level. The mean (SD) PAM score of the participants was 60.6 (± 13.6). The distribution of the PAM scores included 19.7% at level 1, 18.8% at level 2, 26% at level 3, and 35.5% at level 4.

Table 2 shows the association among sociodemographic status, clinical characteristics (HbA1c, diabetic medication), knowledge levels and PAM level. In this study, sex, education, occupation and HbA1c were not associated with high levels of patient activation. Age, smoking status, alcohol consumption, diabetic medication and knowledge level were significantly associated with a high level of patient activation (p<0.05).

The results of the bivariate and multivariate logistic regression analysis are presented in Table 3. Using multivariate logistic regression, being male was statistically associated with patient activation (OR=3.04, 95% CI=1.23–7.54, p=0.016). Not smoking, not drinking or being an ex -drinker were strongly associated with patient activation (OR=4.25, 95% CI=1.48–12.2, p=0.007; OR=5.42, 95% CI=1.66–17.7, p=0.005; OR=4.88, 95% CI=1.31–18.1, p=0.018, respectively. Average or high knowledge levels were strongly associated with patient activation (OR=3.30, 95% CI=1.23–8.83, p=0.017; OR=16.6, 95% CI=5.91–46.4, p<0.001, respectively).

Table 1 Sociodemographic characteristics and clinical parameters of all participants

Socio-demographic characteristics	Number	%
Age (years)		
<40	24	9.6
40-49	74	29.6
50-59	84	33.6
≥60	68	27.2
Sex		
Female	135	54.0
Male	115	46.0
Education		
Primary School	9	3.6
Middle School	42	16.8
High School	77	30.8
University	122	48.8
Occupation		
Government employee	46	18.4
Non-government employee	55	22.0
Self-employed	69	27.6
Retired/Dependent	80	32.0
Smoking Status		
Yes	49	19.6
No	172	68.8
Ex-smoker	29	11.6
Alcohol Consumption		
Yes	43	17.2
No	167	66.8
Ex-drinker	40	16.0
HbA1c Level		
≥7	118	47.2
<7	132	52.8
Diabetic Medication		
Oral anti-diabetic only	231	92.4
Oral anti-diabetic and insulin	13	5.2
Insulin only	6	2.4
Knowledge Level		
Poor	58	23.2
Average	119	47.6
High	73	29.2
PAM Level		
1	50	19.7
2	47	18.8
3	65	26.0
4	88	35.5

PAM: Patient Activation Measure

Table 2 Association between general characteristics, knowledge level and PAM level

Variables	Level 1		Level 2		Level 3		Level 4		*p*
	n	%	n	%	n	%	n	%	
Age (years)									
<40	5	10.0	1	2.1	6	9.2	12	13.6	<0.001
40-49	3	6.0	10	21.3	20	30.8	43	48.9	
50-59	10	20.0	22	46.8	26	40.0	23	26.1	
≥60	32	64.0	14	29.8	13	20.0	10	11.4	
Sex									
Female	26	52.0	24	51.1	42	64.6	43	48.9	0.248
Male	24	48.0	23	48.9	23	35.4	45	51.1	
Education									
Primary School	2	4.0	3	6.4	1	15.0	3	3.4	0.355
Middle School	8	16.0	4	8.5	17	26.2	13	14.8	
High School	17	34.0	13	27.7	16	24.6	31	35.2	
University	23	46.0	24	57.4	31	47.7	41	46.6	
Occupation									
Government	4	8.0	12	25.5	12	18.5	18	20.5	0.622
Non-government	10	20.0	9	19.1	13	20.0	23	26.1	
Self-employee	15	30.0	9	19.1	21	32.3	24	27.3	
Retired	21	42.0	17	36.2	19	29.2	23	26.1	
Smoking Status									
Yes	14	28.0	15	31.9	13	20.0	7	8.0	0.018
No	30	60.0	26	55.3	45	69.2	71	80.7	
Ex-smoker	6	12.0	6	12.8	7	10.8	10	11.4	
Alcohol Consumption									
Yes	11	22.0	17	36.2	8	12.3	7	8.0	0.004
No	32	64.0	25	53.2	46	70.8	64	72.7	
Ex-drinker	7	14.0	5	10.6	11	16.9	17	19.3	
HbA1c									
≥7	21	42.0	24	51.1	26	40.0	47	53.4	0.316
<7	29	58.0	23	48.9	39	60.0	41	46.6	
Diabetic Medication									
Oral antidiabetic only	45	90.0	45	95.7	56	86.2	85	96.6	0.021
Oral antidiabetic and insulin	5	10.0	2	4.3	4	6.2	2	2.3	
Insulin only	0	0.0	0	0.0	5	7.7	1	1.1	
Knowledge Level									
Poor	39	78.0	9	19.1	3	4.6	7	8.0	<0.001
Average	3	6.0	32	68.1	52	80.0	32	36.4	
High	8	16.0	6	12.8	10	15.4	49	55.7	

PAM: Patient Activation Measure; HbA1c: Hemoglobin A1c

Table 3 Bivariate and multivariate logistic regression analysis on level 4 activation score

Variables	Bivariate			Multivariate		
	OR	95% CI	*p*	OR	95% CI	*p*
Age (years)						
<40	1.20	0.44-3.25	0.720	0.94	0.25-3.44	0.926
40-49	1.54	0.76-3.11	0.222	1.81	0.65-5.01	0.251
50-59	1.40	0.70-2.78	0.331	1.79	0.72-4.44	0.210
≥60	1			1		
Sex						
Female	1			1		
Male	1.37	0.81-2.31	0.230	3.04	1.23-7.54	0.016
Education						
Primary School	1			1		
Middle School	0.89	1.94-4.15	0.889	1.43	0.18-11.31	0.731
High School	1.34	0.31-5.79	0.688	2.63	0.36-19.19	0.339
University	1.01	0.24-4.25	0.987	2.12	0.28-16.02	0.465
Occupational Status						
Self-employee	1			1		
Government employee	1.18	0.55-2.54	0.668	0.86	0.33-2.27	0.772
Non-government employee	1.30	0.62-2.71	0.475	1.30	0.46-3.69	0.615
Retired	0.74	0.37-1.47	0.395	0.88	0.35-2.20	0.793
Smoking Status						
Yes	1			1		
No	4.21	1.79-9.92	0.001	4.25	1.48-12.18	0.007
Ex-smoker	3.15	1.04-9.55	0.042	1.41	0.36-5.51	0.619
Alcohol Consumption						
Yes	1			1		
No	3.19	1.34-7.61	0.009	5.42	1.66-17.67	0.005
Ex-drinker	3.80	1.36-10.58	0.11	4.88	1.31-18.11	0.018
HbA1c						
≥7	1			1		
<7	0.76	0.455-1.29	0.323	0.69	0.36-1.35	0.291
Diabetic Medication						
Oral antidiabetic and insulin	1			1		
Oral antidiabetic only	3.20	0.69-14.79	0.136	3.13	0.55-17.59	0.194
Insulin only	1.10	0.08-15.15	0.943	1.99	0.07-50.72	0.676
Knowledge Level						
Poor	1			1		
Average	2.68	1.10-6.51	0.030	3.30	1.23-8.83	0.017
High	14.87	5.87-37.65	<0.001	16.57	5.91-46.4	<0.001

OR: odds ratio; CI: confident interval; HbA1c: Hemoglobin A1c

Discussion

Many studies conducted concerning diabetes knowledge tend to focus on the knowledge, attitudes and perceptions of patients with diabetes. This study was conducted to gain a broad perspective on knowledge and activation of patients. A cross-sectional descriptive study aimed to investigate the association between socio-demographic data, level of diabetes knowledge and patient activation levels among patients with type 2 diabetes, who were attending the diabetes specialist clinic in Yangon, Myanmar. In this study, patient activation was related to age, sex, smoking status, alcohol consumption, medication and diabetes knowledge of the patients.

The knowledge level of the participants was highest at an average level (47.6%) and lowest at a poor level (23%). The lowest knowledge score of the participants (almost 61.6%) concerned signs of diabetic ketoacidosis. The second lowest was regarding types of free food; 53.6% of the participants did not know well. This finding indicated the majority of participants had poor knowledge of weight loss and healthy diet[17].

Multivariate logistic regression analysis showed average and high knowledge levels were associated with a high level of PAM (Table 3). Patients with diabetes with a higher PAM score were more likely to engage in self-care behavior like foot checks and regular exercise. Other research showed that those more activated were more likely to seek and find health information and to understand it better[18]. Even though studies have been conducted on certain important parts of patient activation in diabetes care, gaps continue in fully understanding the implications of patient participation in treatments. However, despite the importance of diabetes self-care behaviors, a disconnect remains in patients who are unable to follow these behaviors and do not ask for any help from their healthcare professionals[19].

Activation was higher in young and middle age groups and lower in old age groups. Knowledge was also higher in young age than old age groups. In this study, knowledge about diabetes was generally good; and knowledge was negatively associated with age and seemingly good knowledge decreased with age. In this study, there were more females than males, and this is similar to the findings of other studies[20,21]. This may be due to clinic-based studies, where females have greater attendance and better care seeking behavior. It also agreed with a study conducted in South India[22].

This study provided valuable baseline data in strong relation to knowledge and patient activation. Good behaviors such as not smoking and not drinking were strongly

associated with patient activation. Most participants (68.8%) were nonsmokers and 66.8% were nondrinkers.

Individuals who are at the early stages of activation require interventions that are designed to increase knowledge about their condition and treatments. Patients at later stages need interventions designed to increase their skills and confidence in different self-management activities. The findings showed that participants overall were confident in engaging and managing their own healthcare. They believed they had an important role and wanted to be actively involved in their rehabilitation process. The majority of participants believed they were able to manage their own symptoms, even at home, but may have regressed or deterred in times of stress.

The diabetic clinic in which the study was conducted is well equipped with special charts and handouts on the recommended diet, and the importance of exercise and other preventive measures, as well as symptoms and complications of type 2 diabetes mellitus. Patients were also frequently advised by medical personnel during their check-ups. Even though these facilities were provided to them, many elderly patients with diabetes still need support to increase their knowledge level and educate them to actively participate in controlling their disease.

In conclusion, among patients with type 2 diabetes, patient activation was related to disease specific knowledge and less with health-related behaviors. Sociodemographic and clinical characteristics, such as marital status, education level, BMI and HbA1c had no influence on patient activation. Higher activation was significantly associated with sex, smoking status, alcohol consumption and diabetes knowledge. In health care practice, we may increase patients' knowledge about diabetes resulting in increasing activation levels of patient participation in treatment.

Based on the finding of this study, the following recommendations are made. Training programs for diabetes management, especially those for middle- and old-aged patients with diabetes should focus on the preventive aspect and screening of complications rather than glycemic control and asymptomatic treatment only. Health education on diabetes should be included in continuing education programs for health care workers. Community health and health promotion strategies of the Ministry of Health and Social Services should be tasked with health education and promotion related to diabetes.

Author contributions

AKT, KW, TO and NNO designed the study and formulated the content of the intervention tools and questionnaires. AKT

conducted the study and patient interviews under the supervision of KW and TSL. AKT and NNO carried out reliability testing and the initial statistical analysis of data and KW supervised the findings of this work. All authors discussed the results and contributed to the final manuscript. AKT wrote the manuscript with support from TO and NNO. All authors read and approved the manuscript prior to submission for publication.

Acknowledgements

I would like to express my sincere appreciation to Professor Tint Swe Latt for allowing me to conduct the research in his diabetes specialist clinic. Finally, I would like to thank all patients with diabetes who participated in this study and staff and nurses for their valuable help while collecting data in Myanmar.

Financial disclosures

The work presented in this article was self-funded.

Conflicts of interest

The authors have no conflicts of interest.

References

1. Shaw JE, Sicree RA, Zimmet PZ. Global estimates of the prevalence of diabetes for 2010 and 2030. Diabetes Res Clin Pract 2010; 87: 4-14.
2. World Health Organization. Diabetes country profiles, 2016 Myanmar. Available from: https://www.who.int/diabetes/country-profiles/mmr__en.pdf 201910
3. Guariguata L, Whiting DR, Hambleton I, Beagley J, Linnenkamp U, Shaw JE. Global estimates of diabetes prevalence for 2013 and projections for 2035. Diabetes Res Clin Pract 2014; 103: 137-49.
4. Agyei-Mensah S, Aikins AG. Epidemiological transition and the double burden of disease in Accra. Ghana J Urban Health 2010; 87(5): 879-97.
5. Bawah A, Houle B, Alam N, Razzaque A, Streatfield PK, Debpuur C, et al. The evolving demographic and health transition in four low- and middle-income countries: Evidence from four sites in the in-depth network of longitudinal health and demographic surveillance systems. PLoS One 2016; 11(6): e0157281.

6. Dans A, Ng N, Varghese C, Tai ES, Firestone R, Bonita R, et al. The rise of chronic non-communicable diseases in Southeast Asia: Time for action. Lancet 2011; 377: 680-9.
7. Dunkley AJ, Bodicoat DH, Greaves CJ, Russell C, Yates T, Davies MJ, et al. Diabetes prevention in the real world: Effectiveness of pragmatic lifestyle interventions for the prevention of type 2 diabetes and of the impact of adherence to guideline recommendations. Diabetes Care 2014; 37(4), 922-33.
8. Mensing C, Boucher J, Cypress M, Weinger K, Barta P, Lasichak A, et al. National standards for diabetes self-management education. Diabetes Care 2007; 30 (suppl 1): S96-S103.
9. Aung E, Donald M, Coll JR, Williams GM, Doi SA. Association between patient activation and patient-assessed quality of care in type 2 diabetes: Results of a longitudinal study. Health Expect 2016; 19(2): 356-66.
10. Molijord IE, Lara-Cabrera ML, Perestelo-Perez L, Rivero-Santana A, Eriksen L, Linaker OM. Psychometric properties of the Patient Activation Measure-13 among out patients waiting for mental health treatment: A validation study in Norway. Patient Educ Couns 2015; 98(11): 1410-7.
11. Hibbard JH, Greene J. What the evidence shows about patient activation: better health outcomes and care experiences. Health Aff 2015; 207-14.
12. Bos-Touwen I, Schuurmans M, Monninkhof EM, Korpershoek Y, Spruit-Bentvelzen L, Ertugrul-van der Graaf I, et al. Patient and disease characteristics associated with activation for self-management in patients with diabetes, chronic obstructive pulmonary disease, chronic heart failure and chronic renal disease: a cross-sectional survey study. PLoS One 2015; 10(5): e0126400.
13. Rask KJ, Ziemer DC, Kohler SA, Hawley JN, Arinde FJ, Barnes CS. Patient activation is associated with healthy behaviors and ease in managing diabetes in an indigent population. Diabetes Educ 2009; 35(4): 622-30.
14. Funnell M, Anderson RM, Arnold MS, Barr PA, Donnelly M, Johnson PD, et al. Empowerment: An idea whose time has come in diabetes education. Diabetes Educ 1991; 17(1): 37-41.
15. World Health Organization. Guidelines for the prevention, management and care of diabetes mellitus. 2006. Available from: http://applications.emro.who.int/dsaf/dsa664.pdf, accessed October 28, 2019.

16. Hibbard JH, Gilburt H. Supporting people to manage their health: An introduction to patient activation. 2014. Available from: https://www.kingsfund.org.uk/publications/supporting-people-manage-their-health, accessed October 28, 2019.
17. Miller LV, Goldstein J, Nicolaisen G. Evaluation of patients; knowledge of diabetes self-care. Diabetes Care 1978; 1(5): 275-80.
18. Hibbard JH, Greene J, Tusler M. Improving the outcomes of disease management by tailoring care to the patient's level of activation. Am J Manag Care 2009; 15: 353-60.
19. Peyrot, M, Burns KK, Davies M, Forbes A, Hermanns N, Holt R, et al. Diabetes attitudes wishes and needs 2 (DAWN2): A multinational, multi-stakeholder study of psychosocial issues in diabetes and person-centred diabetes care. Diabetes Res Clin Pract 2013; 99(2): 174-84.
20. Hilawe EH, Yatsuya H, Kawaguchi L, Aoyama A. Differences by sex in the prevalence of diabetes mellitus, impaired fasting glycaemia and impaired glucose tolerance in sub-Saharan Africa: a systematic review and meta-analysis. Bull World Health Organ 2013; 91: 671-82.
21. Scavini M, Stidley CA, Shah VO, Narva S, Tentori F, Bobelu A, et al. Prevalence of diabetes is higher among female than male Zuni Indians. Diabetes Care 2003; 26(1): 55-60.
22. Malathy R, Narmadha M, Ramesh S, Alvin JM, Dinesh BN. Effect of a diabetes counseling programme on knowledge, attitude and practice among diabetic patients in Erode district of South India. J Young Pharm 2011; 3: 65-72.