



# Medication adherence to Type 2 diabetic patients hospitalized at a tertiary care hospital

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## ABSTRACT

**Introduction:** Diabetes mellitus (DM) has been a global epidemic in the new millennium and the majority of all diabetic patients constitute Type 2 DM. Adherence to specified diabetic treatments is a primary impetus to attain therapeutic success reduces diabetic complications. The aim of the study was to examine the level of medication adherence to Type 2 diabetic patients hospitalized at tertiary care hospitals in Bangladesh.

**Methods:** The study was a descriptive cross-sectional design. A total of 112 Type 2 diabetic patients were conveniently recruited from tertiary care hospitals in Bangladesh.

**Results:** The mean age of the participants was 57.46 (SD=11.65) years. More than half of the patients (60.7%) were male and majority of them (94.6%) were married. The mean score of diabetic medication adherence was calculated as 26.46 (SD=1.58). Adherence to diabetic medications was significantly associated with age ( $p=0.01$ ), occupation ( $p=0.003$ ), duration of DM ( $p=0.003$ ), oral hypoglycemic agents ( $p=0.02$ ), glycosylated hemoglobin (HbA1c) ( $p\leq 0.01$ ), and fasting blood sugar (FBS) ( $p\leq 0.01$ ). Medication non-adherence significantly found in patients with presence of diabetic retinopathy ( $p\leq 0.01$ ), microalbuminuria ( $p=0.001$ ), dyslipidemia ( $p=0.006$ ), hypertension ( $p=0.001$ ), and other chronic diseases ( $p=0.001$ ).

**Conclusion:** The level of medication adherence among Type 2 diabetic patients was found to be suboptimal. Good adherence has desirable sequels on HbA1c and FBS. For improving adherence to diabetic medication, special attention should pay to different age groups and the presence of comorbidities.

**Key words:** Medication adherence; type 2 diabetes mellitus; oral hypoglycemic agents; comorbidities

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## INTRODUCTION

Diabetes mellitus (DM) most commonly fast-growing non-communicable disease is a global epidemic in the new millennium (1) and considered as the largest global health emergencies (2). About



8.8% of people live with diabetes which is expected to increase to 9.9% due mainly to global urbanization by 2045 (2). In Bangladesh, 8.4 million (10%) of total population is affected in diabetes (3) and the prevalence is comparatively higher in urban than rural setting (2,4). Type 2 DM accounts for 90-95% of all diabetes around the world (2,5) is identified as a major health problem in Bangladesh. The prevalence of Type 2 diabetes has an increasing trend in both urban and rural areas in Bangladesh ranged between 4.5% and 3.5% (6), respectively, and those who had higher family income had significantly higher prevalence than those with lower income (7).

The term adherence is “the extent to which a person’s behavior taking medication, following diet, and/or executing lifestyle changes, corresponds with agreed recommendations from a health care provider” (8). Medication adherence has directly influenced on diabetic control and clinical consequences. Logical applications of antidiabetic treatment and congruous adherent to prescribed medications are the main factors to attain medicinal success (9).

The majority of the patients’ low adherence to medication with significantly poor diabetic control was due to forgetfulness, busy work schedule, difficulty in adhering medication plan, education about DM, and their negative beliefs about medicine (10-12). Nonadherence to medication declines the efficacy of the medication leading to poor diabetic control (13) consequently increases the development of diabetic complications. The outcomes of diabetic complications increase hospitalization, direct patient costs, and mortality. Medication adherence to antidiabetic agents has been shown to be more cost effective, as it may reduce the frequency of hospitalization and costs associated with complications (14,15).

Evidence shows that two out of every ten patients with Type 2 diabetes suffered from distress, which was associated with low adherence to drug treatment, consumption of foods with high sugar content due to lack of information (16). Type 2 DM is strongly associated with obesity and a sedentary lifestyle (17). Lifestyle modification alone will not help in controlling blood glucose; hence, use of medication is thus vital in the management of Type 2 DM. However, the usefulness of treatment is contingent on the prescribed medication adherence level (18).

A few studies have been conducted on medication adherence among Type 2 diabetic patients in Bangladesh. However, there was a huge gap in information about medication adherence among patients with Type 2 DM. The previous study identified that the prevalence of patients with Type 2 DM is consistently and significantly increasing (19). Therefore, it was necessary to examine the level of medication adherence among Type 2 diabetic patients in Bangladesh.

## METHODS

### Study design and participants

This study was a descriptive cross-sectional design to examine the level of medication adherence to Type 2 diabetic patients in Bangladesh. The hospitalized patients with Type 2DM were recruited from Bangabandhu Sheikh Mujib Medical University (BSMMU). Patients admitted in medicine and endocrinology wards were the selected samples who met the following inclusion criteria: (1) Patients who were 20 years, (2) patients who had been diagnosed diabetes at least 2 years ago, and (3) ability to speak, read, write and understand Bengali language. Patients who were excluded from this study were (1) patients with a documented history of psychiatric illness, dementia, pregnant, (2) patients with hemochromatosis, acute or chronic pancreatitis, cystic fibrosis, pancreatic cancer, pheochromocytomas, acromegaly and Cushing syndrome, and (3) patients who had more than 3 months use of phenytoin and glucocorticoids.

### Sample size

The required sample size was calculated by G\*Power (version 3.1.2) using an F test (Correlation: Bivariate normal model). Statistical parameters were set as follows:  $\alpha = 0.05$ , medium effect size = 0.3, power  $(1-\beta) = 0.8$ , and correlation  $\rho = 0$ . The calculated sample size was 84 at a minimum. To compromise the attrition rate, 20% more samples were added. Therefore, the final sample size was 112 in this research.

### Data collection

Data were conveniently collected from 112 hospitalized Type 2 diabetic patients who met the criteria from a tertiary care hospital in the

period from December 2018 to January 2019. Before data collection, the proposal was approved by the Institutional Review Board of NIANER and BSMMU (IRB NO.Exp.NIA-S-2018). With the approval and a letter of permission from the Director of NIANER, the researcher asked for permission from the concern authorities of the respected hospital. To achieve the objectives a face to face interview questionnaires and patients medical record review were used to collect data. The questionnaires consist of three main sections include socio-demographic characteristics, disease-related characteristics, and Medication Compliance Questionnaires (MCQ).

Socio-demographic characteristics include age, sex, marital status, income, smoking, occupation, and level of education. Disease-related characteristics consist of medical histories include comorbidities, duration of diabetes, current treatment, body mass index (BMI), fasting blood sugar (FBS), and glycated hemoglobin (HbA1c). The patients' BMI was calculated by taking weight and height. A recent HbA1c report was collected from patients file done within the past 3 months from the time of this study and FBS report done on the day of data collection. Good diabetic control was represented by HbA1c  $\leq 7.0\%$ .

Medication adherence was measured using a previously validated MCQ developed and modified by Ahmad, Ramli, Islahudin & Paraidathathu, 2013 (20) using the Morisky self-reporting scale (21), Hill-Bone Compliance to High Blood Pressure Therapy Scale (22), and Medication Adherence Scale (23). The reliability and internal consistency of the questionnaires was yielded at the Chronbach's  $\alpha$  value of 0.782, and inter-rater reliability was Cohen's kappa statistic value of 0.796. The MCQ was similar, but the original English language MCQ was only translated its Bengali version by a bilingual expert then translated back into English by different experts to ensure its consistency. The spirit of original questionnaires was fostered. A total of seven questions in the MCQ assessed patients' level of adherence to medication prescribed. A 4-point Likert scale was appointed for each question: none of the time = 4; sometimes (1-4 times per month) = 3; most of the time (more than 5 times per month or more than 2 times per week) = 2; and all the time = 1. The total scores were added for each patient. The scores range

from 7 to 28. Based on the scoring system used in the Morisky Medication Adherence Scale, a total score of  $\geq 27$  was considered adherence.

### Data analysis

Data were analyzed using SPSS 21.0 version for windows (SPSS Inc., Chicago, IL, USA). Descriptive statistics were used to measure the demographic characteristics, disease-related characteristics, and medication adherence among the participants. Independent sample t-test and one-way ANOVA with *posthoc* comparisons (Tukey test) were used to examine the relationship between the variables.  $p = 0.05$  was considered statistically significant.

## RESULTS

### General characteristics of the participants

Of the total of 112 respondents, the average age was 57.46 years old (SD=11.65) ranged from 32 to 85 years. The majority of the participants (60.7%) were male and most of them (94.6%) were married. The mean monthly household income was BDT 38285.71 (SD=16783.42). The majority of the patients' (58.9%) monthly income was ranged from BDT 25,000 to 50,000. Most of the subjects (58.8%) were past and current smoker, but less than half of the subjects (40.2%) were nonsmoker. With respect to education, half of the patients (51.8%) had above high school level. Regarding their occupation, below half of the participants (40.2%) was employed, less than one-third (28.6%) were not employed, and nearly one-third of them (31.3%) were businessmen (Table 1).

### Disease-related characteristics of the participants

Results identified that most of the patients had some comorbidities such as diabetic retinopathy (69.6%), hypertension (80.4%), and other chronic diseases (63.4%). Compared to other antidiabetic regimen, the most patients (39.3%) take insulin alone to control diabetes. Results also revealed that the mean of HbA1c and FBS of the participants were 8.78% (SD=2.31) and 9.13mg/dl (SD=3.28), respectively. The duration of diabetes since the onset of illness was ranging from 3 to 25 years with a mean of 9.99 (SD=5.03) years. The majority of the patients

**TABLE 1.** Distribution of socio-demographic characteristics of among the participants (n-112)

Variable	n (%)	Mean±SD
Age (Years)		57.46±11.65
≤40	9 (8.0)	
41-50	22 (19.6)	
51-60	35 (31.3)	
>60	46 (41.1)	
Gender		
Male	68 (60.7)	
Female	44 (39.3)	
Income		38285.71±16783.42
<25,000	24 (21.4)	
25,000-50,000	66 (58.9)	
>50,000	22 (19.6)	
Marital status		
Married	106 (94.6)	
Widow	6 (5.4)	
Smoking		
None	45 (40.2)	
Past	41 (36.6)	
Current	26 (23.2)	
Years of education		
Illiterate	19 (17.0)	
<High School	35 (31.3)	
>High School	58 (51.8)	
Occupation		
Employed	45 (40.2)	
Not Employed	32 (28.6)	
Business	35 (31.3)	

SD: Standard deviation

(70.5%) showed high BMI with a mean of 26.96 (SD=3.03) (Table 2).

**Medication adherence of the participants**

A previously validated 7-items MCQ was used to measure the level of medication adherence among the patients with Type 2 DM, which was ranged in 4-point Likert scale. According to the findings reveal that majority of the participants (72.3%) did never forget to take their medicine, most of them (96.4%) never decided not to take medicine or miss medicine when even feel better. However, the majority of the patients (81.3%) never forgot to bring medicine along with them when they travel. The most patients (97.3%) never forgot to take medicine when they

**TABLE 2.** Distribution of disease-related characteristics among the participants (n-112)

Variables	n (%)	Mean±SD
Diabetic retinopathy	78 (69.6)	
Microalbuminuria	35 (31.3)	
Dyslipidemia	44 (39.3)	
HTN	90 (80.4)	
Others	71 (63.4)	
Current treatment		
OHA alone	24 (21.4)	
Insulin alone	44 (39.3)	
Combination of insulin, OHA	43 (38.4)	
HbA1c (%)		8.78±2.31
≤7	37 (33.0)	
>7	75 (67.0)	
FBS (mmol/l)		9.13±3.28
≤7.0	42 (37.5)	
>7.0	70 (62.5)	
Duration of diabetes (years)		9.99±5.03
<10	61 (54.5)	
≥10	51 (45.5)	
BMI		26.96±3.03
<25	33 (29.5)	
≥25	79 (70.5)	

HTN: Hypertension, OAH: Oral hypoglycemic agents, HbA1c: Glycated hemoglobin, FBS: Fasting blood sugar, BMI: Body mass index

run out from home. The mean scores of MCQs were calculated as 26.46 (SD=1.58) (Table 3).

**Association between socio-demographic characteristics and medication adherence among the participants**

There was a statistically significant correlation found between age and medication adherence (F= 3.52, *p* = 001), and between income and medication adherence (F=2.94, *p* = 005). Significant correlation also found between occupation and medication adherence (F=29.94, *p*< 0.01). Other variables were non-significant toward medication adherence among the Type 2 DM patients (Table 4).

**Relationship between diseases-related characteristics and medication adherence among the participants**

The finding showed that diabetic retinopathy (*t*= -4.26, *p* ≤ 0.01), microalbuminuria (*t*= -2.49, *p* = 001),

**TABLE 3.** Distribution of medication adherence among the participants (n=112)

Variables	Never (4)		Sometimes (3)		Often (2)		Always (1)		Mean (SD)
	n	%	n	%	n	%	n	%	
1. How often do you forget to take your medicine?	81	72.3	29	25.9	2	1.8	-	-	3.71 (49)
2. How often do you decide not to take your medicine?	108	96.4	1	0.9	3	2.7	-	-	3.96 (24)
3. How often do you miss taking your medicine because you feel better?	108	96.4	4	3.6	-	-	-	-	3.96 (18)
4. How often do you decide to take less of your medicine?	54	48.2	55	49.1	3	2.7	-	-	3.46 (55)
5. How often do you stop taking your medicine because you feel sick due to effects of the medicine?	69	61.6	41	36.6	2	1.8	-	-	3.60 (52)
6. How often do you forget to bring along your medicine when you travel away from home?	91	81.3	20	17.9	1	0.9	-	-	3.80 (42)
7. How often do you not take your medicine because you run out of it at home?	109	97.3	3	2.7	-	-	-	-	3.97 (16)
Total mean (SD)									26.46 (1.58)

SD: Standard deviation

dyslipidemia ( $t = -2.77, p = 0.006$ ), hypertension ( $t = -2.62, p = 0.01$ ), and other chronic diseases ( $t = -2.45, p = 0.01$ ) had statistically significantly associated with medication adherence. HbA1c ( $t = 3.93, p < 0.01$ ), FBS ( $t = 3.76, p < 0.01$ ), duration of DM ( $t = 3.00, p = 0.003$ ), and current treatment of oral hypoglycemic agents ( $t = 3.19, p = 0.002$ ) were also statistically significantly correlated with medication adherence. However, other variables were not significant toward medication adherence among patients with Type 2 DM (Table 5).

## DISCUSSION

The present study used to examine the level of medication adherence among patients with Type 2 DM in a tertiary care hospital in Dhaka city. This study identified that the most patients with Type 2 DM were adherent to antidiabetic medication. This revealed that adherence rate was consistent with prior studies (24-26). This may be attributed due to the younger age, shorter duration of diabetes and those who were on treatment of oral hypoglycemic agents. However, another study found that the younger patients tended to have low medication adherence to oral hypoglycemic agents, which were strongly affecting their poorer glycemic control (27). High adherence level was significantly

found in patients with treatment of oral hypoglycemic agents. This result was comparable to the previous studies (28,29). However, another study found that patients on both insulin and oral hypoglycemic agent were nonadherent (30,31), and on the other hand, the patient taking insulin also showed high adherence (32). Interestingly no association also found between the type of treatment and medication adherence (31).

Although the mean score of medication adherence in this study showed higher than the non-adherence level, there were a significant number of patients who were categorized as nonadherent in bivariate analysis. Consistently medication non-adherents also significantly reported in the previous studies (33-35). The most common reason for nonadherent was taking less medicine, stop taking medicine due to its adverse effects and forgetfulness, which was also consistent with the previous findings (11).

In accordance with the previous composition, patients' characteristics related to adherence had been shown to vary. Sex, BMI, and educational level have not been associated with patients' adherence level (20,36). However, the level of education had a significant association with medication

**TABLE 4.** Association between socio-demographic characteristics and medication adherence among the participants (n-112)

Variables	Mean±SD	t/F	p value
Age (Years)		3.52	0.01
≤40	27.67±1.00		
41-50	26.55±2.13		
51-60	26.69±1.32		
>60	26.00±1.58		
Gender		0.004	0.99
Male	26.46±1.53		
Female	26.45±1.67		
Income		2.94	0.05
<25,000	26.83±1.71		
25,000-50,000	26.55±1.59		
>50,000	25.77±1.23		
Years of education		0.868	0.42
Illiterate	26.68±1.41		
<High School	26.17±1.61		
>High School	26.55±1.61		
Occupation		29.94	<0.01
Employed	25.36±1.36		
Not Employed	26.84±1.34		
Business	27.51±1.09		
Smoking		-0.183	0.85
Smoker	26.43±1.53		
Non-smoker	26.49±1.67		
Marital status		0.523	0.47
Married	26.48±1.59		
Widow	26.0±1.41		

SD: Standard deviation

adherence (37). In this study, characteristics include gender, marital status, education level, smoking, and BMI did not ascertain the adherence level. However, age was found to be significantly correlated with medication adherence in our study, and high adherence was mostly seen in younger patients age <40 years. This finding could be due to the fact that younger patients take better care of their health to ensure a longer healthy life and the elderly seem to fear complications and mortality. This reported adherence rate was consistent with the previous findings (36,38,39). However, in the previous studies, higher adherence was found in elderly (39,40) or improves with age (20,41). This may be due to the social and psychological support among the families (36,42).

**TABLE 5.** Relationship between diseases-related characteristics and medication adherence among the participants (n-112)

Variables	Mean±SD	t/F/r	p value
Diabetic retinopathy		-4.26	0.01
Yes	26.06±1.56		
No	27.35±1.22		
Microalbuminuria		-2.49	0.01
Yes	25.91±1.40		
No	26.70±1.60		
Dyslipidemia		-2.77	0.006
Yes	25.95±1.39		
No	26.78±1.61		
Hypertension		-2.62	0.01
Yes	26.27±1.48		
No	27.23±1.77		
Other chronic diseases		-2.45	0.01
Yes	26.18±1.42		
No	26.93±1.73		
BMI		-0.65	0.51
<25	26.30±1.84		
≥25	26.52±1.46		
HbA1c (%)		3.93	0.01
≤7	27.24±1.69		
<7	26.07±1.37		
FBS (mmol/l)		3.76	0.01
≤7.0	27.14±1.67		
<7.0	26.04±1.37		
Duration of DM (Years)		3.00	0.003
<10	26.85±1.62		
≥10	25.98±1.40		
OHA alone		3.19	0.002
Yes	27.33±1.85		
No	26.22±1.41		
Insulin alone		-1.48	0.14
Yes	26.18±1.45		
No	26.63±1.64		
Combination therapy of OHA and Insulin		-1.30	.19
Yes	26.21±1.39		
No	26.61±1.68		

DM: Diabetes mellitus, OHA: Oral hypoglycemic agents, HbA1c: Glycated hemoglobin, FBS: Fasting blood sugar, BMI: Body mass index

On the basis of occupation, there were also significant relationships with medication adherence. Employed was found to be significantly



nonadherent to antidiabetic medication than not employed and businessman. Our finding was consistent with the previous studies (42). This non-adherence rate was due to the younger patients because they skip or forget to take their medication due to professional busyness. In contrast to this finding, the employed was more adherents to oral antidiabetic drugs than jobless working-age individuals with diabetes (32). Controversially, no statistically significant relationship was found between occupation status and adherence to diabetic treatments (31,37,43). To avoid controversy, further studies are recommended to find out the possible contribution of occupational status to patients' medication adherence.

Disease-related characteristics that were significantly associated with non-adherence were HbA1C, FBS, duration of diabetes, and some existing comorbidities such as diabetic retinopathy, microalbuminuria, dyslipidemia, hypertension, and other chronic diseases. This finding was mostly similar to the previous studies (20,36). Compound treatment of diabetic patients with existing comorbidities usually has various drugs of such as antihypertensive drugs, lipid-lowering agents, and anti-platelets drugs could be a reason for nonadherence to diabetic medication (20).

Interestingly, this study finding demonstrated that medication adherence plays an important role in maintaining blood sugar levels within the normal range. This study found a significant inverse relationship between high adherence scores and lower assayed values of HbA1C and FBS. Similar findings were also reported in the previous studies (11,32,44). In contrast to these findings, another study reported that medication adherence was not significantly associated with glycemic control status (45). This was due to the sample size in that study was too small to detect any significant association between medication adherence and glycemic control. In addition, the duration of Type 2 DM was also found to affect the patients' medication adherence level, where patients having shorter history of diabetes to score higher adherence level. In contrast to this finding, it was reported that higher adherence shown in patients having a longer history of diabetes (29). This may be attributed to having more diabetic knowledge.

This study has also few limitations. First, it was only undertaken at one hospital in the capital city of Bangladesh. Therefore, results may vary in patients with diabetes living in rural areas. Second, only hospitalized patients were selected to participate in this study. Findings may not be generalized to patients followed at the outpatients department and primary care centers. Finally, this study does not indicate the factors affecting diabetic medication.

## CONCLUSION

Most patients in this study were found to be medication adherents, but nonadherence to diabetic medication was significantly seen in patients with different age groups, occupations, and the presence of comorbidities. Good adherence has beneficial effects on HbA1c and FBS. Particular focus is required for patients with different age groups and comorbidities and creates awareness about the consequences of medication adherence and nonadherence. The findings point toward the need for further studies to explore factors affecting medication adherence among Type 2 DM patients. This study is novel and provides the first study to evaluate the adherence of diabetic medication in Bangladesh.

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