

Predictors of Treatment Regimen Compliance and Glycemic Control among Diabetic Patients Attending in a Tertiary Level Hospital

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ABSTRACT

Background: Treatment regimen compliance is a common problem in individuals with diabetes, making glycemic control difficult to attain. Hence, this study was conducted to identify the predictors of treatment regimen compliance and glycemic control among diabetic patients.

Methods: A descriptive Cross sectional research design was carried out in Tribhuvan University Teaching Hospital. Data was collected through purposive sampling technique among 422 respondents attending in medical OPD using structured questionnaire through interview method. Analysis was done by descriptive and inferential statistics.

Results: The study findings revealed that 20.9 % respondents had good, 53.6% had fair and 25.5% respondents had poor treatment compliance and 60% respondents had good glycemic control. Treatment regimen compliance tends to be significantly associated with sex, education, occupation, attending diabetic counseling, duration of diabetes mellitus, frequency of follow up visit and knowledge level (p value <0.05). The major predictors of treatment regimen compliance were attending in diabetic counseling [Adjusted odds ratio (AOR)= 4.972, 95% CI 2.435-10.151] and level of knowledge (AOR=2.351 95% CI 1.897- 6.161) where as duration of diabetes (AOR=0.954 95% CI 0.559-1.628) was the predictor of glycemic control among diabetic patient.

Conclusions: Diabetic patients attending in diabetic counseling, with adequate knowledge have good compliance and longer duration of disease decreases the glycemic control.

Keywords: Compliance; diabetic patient; glycemic control; predictors; treatment regimen.

INTRODUCTION

The burden of diabetes is considerably high especially in developing countries.¹ Compliance to treatment is important for the management of type 2 diabetes mellitus. The rate of treatment compliance varies according to the disease characteristics, treatment regimen and patient features.^{2,3}

Despite the availability of different treatment modalities for type 2 diabetes, studies have indicated that less than 50% of patients achieve the glycemic goals recommended by the American Diabetes Association (ADA) and approximately two-thirds die prematurely of cardiovascular disease.⁴

Though various studies have emphasized the importance of achieving optimal glucose control through strict adherence to medications, diet, and exercise in order to

minimize serious long-term complications.^{5,6} In Nepalese context, non compliance to treatment regimen is one of the priority problems as treatment and management of diabetes is a major challenge.⁷ Hence, this study aimed to identify the predictors of treatment regimen compliance and glycemic control among diabetic patient.

METHODS

A descriptive cross-sectional research design was adopted. The research setting was the Medical OPD of Tribhuvan University Teaching Hospital (TUTH). Non probability purposive sampling technique was adopted and the sample size was 422 respondents that was calculated based on 50% prevalence of poor glycemic control.⁸ All patients diagnosed as type II DM, on treatment for 3 month and more and attending at Medical OPD in the endocrine OPD day were included in the study. Data was collected after getting formal

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approval from University Grants Commission (UGC) as a faculty research grant and obtaining ethical clearance from Institutional Review Board of Institute of Medicine, Tribhuvan University. Administrative written permission was obtained from the TUTH, written consent was obtained from each respondent prior to data collection. Respondents' participation in the study was voluntarily and withdrawal from the study at any time without giving reason was considered.

Data was collected from 25th December 2017 to 23rd March 2018 by using structured questionnaire with direct interview technique addressing the following aspect; Part I: Demographic characteristics, Part II: Patient's knowledge on diabetes. Knowledge was assessed in different aspects i.e. diabetes mellitus, diet, exercise, medicine, diabetic foot care, blood test, follow up and complication. Part III: Treatment regimen compliance which refers to the patients' behaviors in terms of following diet, exercise, taking medicine and follow up advice as per the health care providers' recommendation for maintaining health. The level of compliance was categorized in different level based on total score.⁹ Part IV: latest record review of blood sugar level for exploring patient's glycemic status. Based on the literature review and as per the laboratory (blood collection) practice of Tribhuvan University Teaching Hospital in this study, fasting blood sugar level was used for glycemic control instead of preprandial capillary plasma glucose level as mentioned in American Diabetes Association (ADA) Diabetes Guideline Summary Recommendation, 2016¹⁰ where as glycemic level was assessed by using the reference value of ADA guideline. Glycemic control was categorized as good glycemic control if fasting blood glucose is ≤ 130 mg/dl and poor glycemic control if fasting blood glucose is more than >130 mg/dl. Similarly, we review postprandial glucose level instead of peak post prandial capillary glucose level as per the hospital practice. The validity of the instrument was established by consulting with HOD of Internal Medicine and Unit Chief, Senior Dietician, subject matter experts and reviewing the related literature. During data collection, confidentiality was maintained by using code number in each form and they were also assured that the provided information would be used only for the study purpose. The collected data was entered into SPSS version 16 and analysis was done by using descriptive and inferential statistics (chi-square test, multivariate logistic regressions).

RESULTS

Table 1. Respondents' level of treatment regimen compliance and status of blood sugar level (n=422).

Variables	Frequency	Percent (%)	Mean \pm SD
Level of compliance			
Good Compliance (>75%)	88	20.9	61.88 \pm 15.69
Fair Compliance (50%-75%)	226	53.6	
Poor Compliance (<50%)	108	25.5	
Status of blood sugar level			
Fasting blood sugar level			
Good controlled (≤ 130 mg/dl)	253	60.0	135.07 \pm 54.04
Poor controlled (>130 mg/dl)	169	40.0	
Post prandial blood sugar level			
Good controlled (≤ 180 mg/dl)	227	53.8	197.27 \pm 88.44
Poor controlled (>180 mg/dl)	195	46.2	
Glycated hemoglobin (HbA1c) (n=179)			
≤ 7	85	47.5	7.61 \pm 2.02
> 7	94	52.5	

Table 1 revealed more than half (53.6%) of the respondents had fair compliance followed by good compliance (20.9%) and poor compliance (25.5%). The mean compliance score was 61.88 \pm 15.69. Regarding status of blood sugar level more than half (60%) of the respondents had controlled fasting blood sugar level i.e. ≤ 130 mg/dl and 53.8% had good controlled of postprandial blood sugar level. And among 179 respondents, nearly half (47.5%) of the respondents had Glycated hemoglobin (HbA1c) > 7 however other remaining reports of the HbA1C was not available at the time of interview.

Table 2 showed the association between treatment regimen compliance with selected variables. The findings reveal the significance association between treatment regimen compliance with sex, education, occupation and attending diabetic counseling (p-value < 0.05).

Table 2. Association between overall treatment regimen compliance and selected variables (n=422).

Variables	Level of Compliance			χ^2 Value	p- value
	Good	Fair	Poor		
Age in completed years					
≤40	10 (16.9%)	32 (54.3%)	17 (28.8%)	2.634	0.621
41 - 60	48 (21.2%)	127 (55.9%)	52 (22.9%)		
> 60	30 (22.1%)	67 (49.2%)	39 (28.7%)		
Sex					
Male	51 (26%)	105 (53.6%)	40 (20.4%)	8.530	0.014*
Female	37 (16.4%)	121 (53.5%)	68 (30.1%)		
Education level					
Illiterate	8 (8.2%)	52 (53.1%)	38 (38.7%)	30.638	<0.001*
Primary level	27 (20.6%)	66 (50.4%)	38 (29.0%)		
Secondary level	23 (21.9%)	60 (57.1%)	22 (21%)		
Higher secondary level and above	30 (34.1%)	48 (54.5%)	10 (11.4%)		
Occupation					
Service	24 (35.3%)	32 (47.1%)	12 (17.6%)	33.936	< 0.001*
Business	13 (15%)	57 (65.5%)	17 (19.5%)		
Agriculture	9 (14.1%)	28 (43.7%)	27 (42.2%)		
Homemaker	22 (16.9%)	68 (52.3%)	40 (30.8%)		
Retired	16 (34%)	23 (48.9%)	8 (17.1%)		
Unemployed	4 (15.4%)	18 (69.2%)	4 (15.4%)		
Area of Residence					
Urban	81 (22.6%)	191 (53.2%)	87 (24.2%)	5.160	0.076
Rural	7 (11.1%)	35 (55.6%)	21 (33.3%)		
Attended diabetic counseling					
Yes	78 (28.8%)	140 (51.6%)	53 (19.6%)	34.121	<0.001*
No	10 (6.6%)	86 (57%)	55 (36.4%)		

*P value significance in <0.05

Table 3. Association between overall treatment regimen compliance and personal factors (n=422).

Variables	Level of Compliance			χ^2 Value	p-value
	Good	Fair	Poor		
Family history of diabetes					
Yes	36 (19.9%)	108 (59.7%)	37 (20.4%)	5.638	0.060
No	52 (21.5%)	118 (49%)	71 (29.5%)		
Duration of DM in years					
< 1	6(12.3%)	23(46.9%)	20(40.8%)	21.145	0.002*
1 - 5	35(22.3%)	73(46.5%)	49(31.2%)		
5 - 10	21(19.6%)	60(56.1%)	26(24.3%)		
>10	26(23.9%)	70(64.2%)	13(11.9%)		
History of hospitalization due to DM					
Yes	18(16.1%)	64(57.1%)	30(26.8%)	2.123	0.346
No	70(22.5%)	162(52.3%)	78(25.2%)		

Frequency of follow up visit					
Every 3 monthly	48(24.6%)	106(54.4%)	41(21%)		
Every 6 monthly	1(3%)	24(72.7%)	8(24.3%)		
Yearly	5(25%)	8(40%)	7(35%)	16.991	0.030*
As per advice	14(14.4%)	53(54.7%)	30(30.9%)		
As per need	20(26%)	35(45.5%)	22(28.5%)		
Knowledge Level					
Adequate (>75%)	52(33.8%)	87(56.5%)	15(9.7%)	68.604	<0.001*
Moderate (50-75%)	31(16.9%)	105(57.4%)	47(25.7%)		
Inadequate (<50%)	5(5.9%)	34(40%)	46(54.1%)		

*P value significance in <0.05

Table 4. Association between fasting blood sugar with personal factors (n=422).

Variables	Fasting Blood Sugar		X ² Value	P- Value
	Controlled (≤130mg/dl)	Uncontrolled (>130mg/dl)		
Family history of diabetes				
Yes	106(58.6%)	75(41.4%)	2.55	0.614
No	147(61%)	94(39%)		
Duration of DM in years				
< 1	39(79.6%)	10(20.4%)	13.911	0.003*
1 - 5	100(63.7%)	57(36.3%)		
5 - 10	59(55.1%)	48(44.9%)		
>10	55(50.5%)	54(49.5%)		
History of hospitalization due to DM				
Yes	106(58.6%)	75(41.4%)	0.255	0.614
No	147(61%)	94(39%)		
Frequency of follow up visit				
Every 3 monthly	124(63.6%)	71(36.4%)	7.272	0.122
Every 6 monthly	17(51.5%)	16(48.5%)		
Yearly	7(35%)	13(65%)		
As per advice	59(60.8%)	38(39.2%)		
As per need	46(59.7%)	31(40.3%)		
Knowledge Level				
Adequate (>75%)	90(58.4%)	64(41.6%)	1.814	0.404
Moderate (50-75%)	116(63.4%)	67(36.6%)		
Inadequate (<50%)	47(55.3%)	38(44.7%)		

*P value significance in <0.05

Table 3 showed the significance association between treatment regimen compliance with duration of diabetes mellitus, frequency of follow up visit and level of knowledge (p-value <0.05).

Table 4 showed the association between glycemic control (fasting blood sugar) with personal factors. The findings reveal that duration of diabetes tends to be significantly

affected in glycemic status as majority (79.6%) of the respondents with less than one year duration of diagnosed diabetes mellitus had controlled fasting blood sugar (FBS) and only 50.5% respondents diagnosed more than 10 years had controlled FBS where as other selected variables showed insignificant association (p> 0.05).

Table 5. Predictors of treatment regimen compliance with different variables (n=422)

Variables	AOR (95%CI)				
	OR	Lower	Upper	p- value	
Sex	Male	1.392	0.819	2.363	0.221
	Female	Ref			
Educational level	Can't read and write	Ref			0.215
	Primary level	0.993	0.430	2.295	
	Secondary level	1.073	0.455	1.455	
	Higher secondary level and above	1.125	0.477	2.477	
Occupation	Service	Ref			0.873
	Business	0.911	0.421	1.970	
	Agriculture	0.469	0.198	1.111	
	Homemaker	2.250	0.959	4.425	
	Retired	0.470	0.215	1.027	
	Unemployed	0.833	0.026	1.005	
Attended diabetic counseling	Yes	4.972	2.435	10.151	<0.001*
	No	Ref			
Duration of Diabetes (yrs)	< 1	Ref			0.15
	1- 5	2.069	0.814	5.260	
	5- 10	0.875	0.329	2.328	
	>10	1.043	0.399	2.726	
Frequency of follow up visit	Every 3 monthly	1.019	0.557	1.865	0.801
	Every 6 monthly	0.005	0.001	1.036	
	Yearly	0.011	0.003	1.034	
	As per advice	0.168	0.078	1.359	
	As per need	Ref			
Knowledge Level	Adequate (>75%)	2.351	1.897	6.161	<0.001*
	Moderate (50-75%)	1.243	1.159	1.335	
	Inadequate (< 50%)	Ref			

Note: Ref- Reference group for comparison in the multiple logistic regression analysis. *- Statistically significant, OR- Odds ratio

Table 5 revealed the overall predictors of treatment regimen compliance. Multiple logistic regressions was used for determining predictors among the significantly associated variables with overall treatment regimen compliance where only attending diabetic counseling and level of knowledge were found to be major predictors at 5% significance level. Those who had attended diabetic counseling are 4.972 times more likely to have good treatment compliance than other group. Similarly, those who had adequate knowledge have 2.351times more likely and those with moderate knowledge have 1.243 times more likely to have good compliance than those who had inadequate knowledge.

Table 6. Predictor of glycemic control among the respondents(n=422).

Variable	AOR (95% CI)			p- value	
	OR	Lower	Upper		
Duration of diabetes (in years)	< 1	1.442	1.177	1.767	<0.001*
	1- 5	1.919	1.168	3.154	
	5-10	0.954	0.559	1.628	
	>10	Ref			

Note:Ref- Reference group for comparison in the multiple logistic regression analysis. *- Statistically significant, OR- Odds ratio

Table 6 reveals the predictors of glycemic control. Multiple logistic regression was used to determine the predictor of glycemic control. The findings reveal that duration of diabetes significantly affect the glycemic control in which those respondents who had diabetes for less than one year have 1.442 times more likely to have controlled fasting blood sugar level than longer duration. Similarly, those who have diabetes for 1-5 years have 1.919 times more likely to have controlled blood sugar.

DISCUSSION

The findings of the present study reveal attending diabetic counseling and level of knowledge were found to be major predictors of treatment regimen compliance among the diabetic patient. Those who had attended diabetic counseling are 4.972 times more likely to have good treatment compliance than other group. In the practice of Tribhuvan University teaching hospital, dietician and nursing personnel conduct the counseling session about half an hour depending upon individual needs. They counsel regarding foot care, diabetic diet, meal planning, blood glucose monitoring and follow up. Regarding knowledge on diabetes, those diabetic patients who had adequate and moderate knowledge level have 2.351 times & 1.243 times respectively more likely to have good compliance than who had inadequate knowledge. According to Chavan et al., the compliance to the management of diabetes was better in patients with good knowledge.¹¹ Taha, EL-Azeaz and EL- Razik concluded that most type-2 diabetic patients in the study setting have inadequate compliance and unsatisfactory knowledge regarding management of Diabetes Mellitus.¹²

The recommended preprandial capillary plasma glucose in diabetic patients should be 80-130mg/dl (7.2 mmol/L) as per American Diabetes Association (ADA),¹³ since values higher than this are associated with risks of microvascular complications. The present study depicts more than half of the respondents (60%) had controlled fasting blood sugar level i.e. \leq 130mg/dl. and among 179 respondents, 52.5% had HbA1c $>$ 7% which might be due to high cost of test and unawareness about the importance of HbA1c in assessing glycemic status. Other study findings revealed that the proportion of poor glycemic control was significantly higher (76.4%).¹⁴ More than two-third (70.9 %) of the patients had poor blood glycemic control in South West Ethiopia.¹⁵ Moreover, significantly high proportion (69.7%) of respondents had poor glycemic control in Tanzania.⁵ The reason for the difference in the rate of glycemic control between present study and other studies may be the variation in personal and clinical characteristics of the respondents and reference for assessing glycemic control.

Present study determines that duration of diabetes significantly associated with glycemic control in which those respondents who had diabetes for 1-5 years (AOR 1.919 times) and between 5-10years (AOR 0.954 times) likely to have controlled blood sugar. Similar to this study, Mansour et al. reported that respondents with poor glycemic control were significantly associated with duration of diabetes mellitus ($p < 0.05$)¹⁴ which was further supported by Kamuhabwa and Charles.⁵ According to Yigazu and Desse, the level of education ($p < 0.001$) and duration of diabetes treatment ($p < 0.001$) were significantly associated with glycemic control. Diabetes treatment for 5-10 years (AOR = 4.64, 95% CI 1.79-12.06, $p = 0.002$) are found to be independent predictors of glycemic control among type 2 diabetes patients.¹⁶ But, a study of Gopinath et al. showed that longer duration of diabetes was not significantly ($p = 0.142$) associated with poor glycemic status¹⁷ which was inconsistent with present study.

In present study glycemic control was equally seen poor in the age $<$ 40yrs and $>$ 60yrs (50.8%), female (41.6%), illiterate (44.9%), those involved in business (48.3%), not attending in diabetic counseling (43.7%), equally having family history and history of hospitalization (41.4%), yearly follow up visit (65%) rather than every 3 monthly, inadequate knowledge (44.7%) but there was no significance association between glycemic control (fasting blood glucose) with these variables ($p \geq 0.05$). This findings was supported by the study of Almutairi et al. which reveals poor glycemic control was highest (82.8%) and (87.5%) in aged 60 years and above and with no formal education respectively.¹⁴ But there was also no significant association ($p > 0.05$) between sex, age group, level of education, working status and glycemic control.^{5,14} Rathi et al. reported that good glycaemic control was not differ significantly by age and gender.¹⁸ Kassahun et al. reported that patients who were illiterate (AOR = 3.46, 95 % CI 1.01-11.91) and farmer (AOR = 2.47, 95 % CI 1.13-5.39) had more likely to have poor glycemic control.¹⁵

Though nearly half of the respondents had history of previous hospitalization, the information regarding purposes of hospitalization (e.g. risk/ symptoms of hypoglycemia and other complications associated with diabetes) was not assessed. Similarly type of anti-diabetic medication may also affect the glycemic control but in present study, this data had not been collected so it might come under the limitation of the study.

In overall level of treatment compliance, 20.9% respondents had good compliance, 53.6% had fair compliance followed by 25.5% respondents had poor

compliance among the diabetic patients. Similar to present study, Attyia and et al, revealed that among 339 respondents, 23.9% were found to have good compliance, 38.6% had a fair compliance, and 37.5% had poor compliance⁹ which is consistent with present study. The limitation of the study was the reference for assessing glycemic control. Though Hb1Ac is an established gold standard in assessing glycemic control as recommended by ADA, in present study, patient's fasting blood sugar level was used to assess status of glycemic control as there was no HbA1c report available among all respondents during the period of data collection.

CONCLUSIONS

The study findings concluded that the major predictors of treatment regimen compliance tend to be attending diabetic counseling and knowledge level of the respondents. Similarly, major predictor in glycemic control tends to be duration of diabetes mellitus. Moreover, compliance with treatment regimen tends to be significantly associated with sex, education, occupation, attending diabetic counseling, duration of diabetes, frequency of follow up visit and adequate knowledge. Hence, hospital authority should promote the activities to increase more compliance in treatment regimen and the diabetes management team needs to intensify the management for the better control of diabetes.

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