

Association of Functional Health Literacy with Glycemic Control: A Cross Sectional Study in Urban Population of Bangladesh

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Abstract

Background: Diabetes mellitus is responsible for significant morbidity and mortality around the world though there is huge development regarding its treatment. Many studies showed that functional health literacy has a great impact on diabetes outcome. The study assessed the relationship between functional health literacy and glycemic control in a sample of urban diabetic patients.

Materials and methods: A cross-sectional study was conducted in Bangladesh University of Health and Science Hospital, Jurain, Dhaka from January to December 2014 that included adult diabetic patients on the basis of defined selection criteria following the purposive sampling method. Functional health literacy was assessed with the short form Test of the Functional Health Literacy in Adults (s-TOFLA). Recent HbA1c was used as a measure of glycemic control and categorized into tight, fair and inadequate glycemic control. Regression models were controlled for demographic data, diabetes duration, treatment regimen, diabetes knowledge and assistance for taking medications.

Results: Following the s-TOFLA scale, 60.5% of the diabetic patients had inadequate functional health literacy of them, 89.3% had inadequate glycemic control (HbA1c>8%). And those who had adequate functional health literacy (24%) of them 68.8% had tight glycemic control (HbA1c ≤7%). Overall 63.0% of the respondents had inadequate glycemic control. In linear regression model low s-TOFLA scores, longer diabetes duration and lack of assistance for taking medications were associated with higher levels of HbA1c. In fully adjusted model s-TOFLA score was the variable which was more strongly associated with HbA1c ($\beta = -0.60, P < 0.001$).

Conclusions: The study found that low health literacy is consistently associated with inadequate glycemic control.

Key words: Functional health literacy, Glycemic control, Diabetes mellitus, HbA1c.



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Introduction:

The term 'functional health literacy' (FHL) has been used to imply one's ability to function adequately in healthcare settings, as determined by instruments which access basic skills needed to deal with health-related written materials.^{1,2} Low health literacy is recognized as a stronger predictor of a persons' health than age, income, employment status, education level, or race, and is associated with a wide range of adverse effects on care processes and health outcomes.^{3,4} Poor health literacy is more common among patients with chronic medical conditions, such as diabetes mellitus (DM), asthma, chronic obstructive pulmonary disease (COPD),

acquired immunodeficiency syndrome (AIDS) and hypertension.⁵ Patients with poor health literacy have greater difficulties naming their medications and describing indications, more frequently hold health beliefs that interfere with adherence and are more likely to have poor understanding of their condition and its management.⁶ Inadequate FHL has been independently associated with poorer ability to take medications appropriately, lower utilization of preventive services, more hospitalizations, poorer overall health status and higher mortality rates.^{7,8}

DM is a major disease that is becoming more prevalent, affecting more than 171 million people worldwide. According to the International Diabetes Federation (IDF) report (2011), Bangladesh now leads the world with 8.4 million diabetic patients, and this number is projected to increase to 16.8 million by the year 2030.⁹ In Bangladesh, a higher prevalence of diabetes was found in urban (8.1%) compared with rural (2.3%) populations.¹⁰ Poor FHL has been independently associated with worse glycemic control and good understanding of diabetes medications has been associated with better glycemic control.¹¹ Several factors have been associated with poor glycemic control, including lower educational level, older age, lower income, longer diabetes duration, and lack of English language. Of these, lower education level and longer duration have consistently emerged as an independent risk factor for poor glycemic control.^{12,13}

The aim of the study was to assess the relationship between functional health literacy and glycemic control of diabetic patients among the urban population.

Materials and methods:

It was a cross-sectional study conducted among adult diabetic patients in Bangladesh University of Health and Science (BUHS) Hospital, Jurain, Dhaka from January 2014 to December 2014. Study participants were selected on the basis of defined selection criteria following the purposive sampling method where inclusion criteria were; age ≥ 18 years, diabetes duration >1 year, had been taking anti-diabetic agents and had a recent Glycated haemoglobin (HbA1c) report. Patients were ineligible if they had visual, hearing, speech problem and cognitive impairment or had been suffering from myocardial infarction, stroke, end stage renal failure, thyroid dysfunction, and mental illness. Written informed consent was obtained before the interview. A semi structured questionnaire was developed to collect the data that was prepared by using the selected variables according to objectives including some scales related to study (s-TOFLA, DKQ-10) and blood analysis report (HbA1c).

Measures:

FHL was assessed by the short form Test of the Functional Health Literacy in Adults (s-TOFLA), a validated instrument to evaluate the ability to read and understand health care information and medical advices given to the patients and categorize into inadequate (0-16), marginal (17-22) and adequate (23-36).¹⁴ Diabetic knowledge was assessed by DKQ-10 scale.¹⁵ To measure glycemic control, HbA1c report was used. A rise of 1% in HbA1c corresponds to an approximate average increase of 2 mmol/L (36 mg/dL) in blood glucose. Normal range of HbA1c is 4-6%.¹⁶ According to HbA1c the patients were categorized into tight control ($\leq 7\%$), fair control (7.1-8%) and inadequate control ($>8\%$) of diabetes.¹⁷

Statistical analysis:

Data were analyzed by using SPSS (statistical package for social science) statistical software version 21.0 for windows. The findings of the study were presented by frequency, percentage in tables. Mean and standard deviation (SD) for continuous variables and frequency distribution for categorical variable were used to describe the characteristics of the total sample. Relationships of the categorical data were assessed using ANOVA, Fisher exact and Chi-square test. Regression analyses were used to explore the association between functional health literacy and glycemic control while controlling for other potentially confounding variables. In primary analyses, functional health literacy and glycemic control were used as continuous variables in multiple linear regressions. In these models, HbA1c was the dependent variable and FHL was the primary independent variable.

Results:

Study sample consisted of 200 adult diabetic patients with a mean age of 48.86 years (SD \pm 10.4) where 137 patients were female and 63 were male. Among them 58.5% had been suffering from DM more than 5 years and receiving oral anti-diabetic agents (OADs) (58.5%), combination of OADs and insulin (29.5%) or insulin alone (12%). The mean HbA1c of the study population was 8.97% (SD \pm 1.9) and 63% patients had inadequate glycemic control (HbA1c $>8\%$), 17% fair control (HbA1c 7.1-8%) and tight glycemic control (HbA1c $\leq 7\%$) in 20%. Inadequate health literacy (s-TOFLA, 0-16) was found in 60.5% respondents, marginal (s-TOFLA, 17-22) 15.5% and 24.0% had adequate (s-TOFLA, 23-36) health literacy. Inadequate health literacy was more likely in patients with age >40 years, female, undergraduates, home makers, those with diabetes duration more than 5 years and patients receiving OADs ($p < 0.05$) (Table I). The participants who had inadequate FHL, most of them (89.3%) had poor glycemic

control and those who had adequate FHL, of them 68.8% had tight glycemic control (Table II). In linear regression model low s-TOFLA scores, longer diabetes duration and lack of assistance for taking medications were associated with higher levels of HbA1c. After adjustment for age, sex, education, occupation, treatment regimen, assistance, duration of disease and diabetes knowledge; only the s-TOFLA score, diabetes duration and lack of assistance were

independently very strongly associated with HbA1c (P<0.001) (Table III). For each 1 SD increase in s-TOFLA score, the HbA1c value would be decreased by 0.60 and thus improve glycemic control. In fully adjusted model s-TOFLA score was the variable more strongly associated with HbA1c ($\beta = -0.60$, P<0.001). It means that if all other variables remained constant, a 1 SD increase on s-TOFLA score would be associated with an improvement of 0.60 SD on predicted HbA1c.

Table I
Characteristics of the patient stratified by functional health literacy level.

Characteristics		Functional health Literacy Level			Total (n=200)	P value		
		Inadequate (0-16) (n=121)	Marginal (17-22) (n=31)	Adequate (23-36) (n=48)				
Education	Illiterate	20 (16.5%)	2 (6.5%)	1 (2.1%)	23 (11.5%)	P<0.001		
	Primary completed	8 (6.6%)	2 (6.5%)	0 (0%)	10 (5.0%)			
	Under graduate	50 (41.4%)	6 (17.0%)	5 (10.9%)	61 (30.5%)			
	Graduate	43 (35.5%)	28 (67.8%)	42 (87.6%)	106 (53.0%)			
Occupation	Service	10 (8.3%)	10 (32.3%)	35 (72.9%)	55 (27.5%)	P<0.001		
	Business	17 (14.0%)	5 (16.1%)	3 (6.2%)	25 (12.5%)			
	Home maker	89 (73.6%)	15 (48.4%)	8 (16.7%)	112 (56.0%)			
	Retired	1 (0.8%)	0 (0%)	1 (2.1%)	2 (1.0%)			
	Student	2 (1.7%)	1 (3.2%)	1 (2.1%)	4 (2.0%)			
	Others	2 (1.7%)	0 (0%)	0 (0%)	2 (1.0%)			
	Diabetes duration (Year)	≤ 5	24 (19.9%)	15 (48.4%)	44 (97.7%)		83 (41.5%)	P<0.001
		6-10	72 (59.5%)	13 (41.9%)	3 (6.2%)		88 (44.0%)	
11-15		17 (14.0%)	0 (0%)	1 (2.1%)	18 (9.0%)			
16-20		7 (5.8%)	3 (9.7%)	0 (0%)	10 (5.0%)			
>20		1 (0.8%)	0 (0%)	0 (0%)	1 (0.5%)			
Treatment regimen	Insulin	16 (13.2%)	4 (12.9%)	4 (8.3%)	24 (12.0%)	P<0.001		
	OADs	57 (47.1%)	20 (64.5%)	40 (83.3%)	117 (58.5%)			
	Insulin + OADs	48 (39.7%)	7 (22.6%)	4 (8.3%)	59 (29.5%)			
Other's assistance	Yes	9 (7.4%)	3 (9.7%)	2 (4.2%)	14 (7.0%)	P=0.616		
	No	112 (92.6%)	28 (90.3%)	46 (95.8%)	186 (93.0%)			
Diabetes knowledge	Good (>7)	102 (84.3%)	28 (90.3%)	44 (91.7%)	174 (87.0%)	P=0.366		
	Average (5-7)	19 (15.7%)	3 (9.7%)	4 (8.3%)	26 (13.0%)			

Table-II
Functional health literacy and HbA1c of the patients (n=200)

Glycemic control	Functional health literacy			Total (n=200)
	Inadequate (0-16) (n=121)	Marginal (17-22) (n=31)	Adequate (23-36) (n=48)	
Tight (≤7%)	5 (4.1%)	2 (6.5%)	33 (68.8%)	40 (20.0%)
Fair (7.1-8%)	8 (6.6%)	13 (41.9%)	13 (27.1%)	34 (17.0%)
Inadequate (>8%)	108 (89.3%)	16 (51.6%)	2 (4.2%)	126 (63.0%)

Table 3: Association between patients characteristics and HbA1c (n = 200)

Model	R	R ²	Adjusted R ²	Df	F	Sig
Regression	0.79	0.63	0.60	14	22.4	0.000
Residual				185		

Characteristics	Unstandardized	Coefficients	Standardized	t	P value
	B	SE	Beta		
Constant	7.00	1.82		3.85	0.000
Age	-0.02	0.01	-0.08	-1.06	0.289
Sex	-0.06	0.25	-0.01	-0.24	0.810
Education	-0.07	0.11	-0.06	-0.62	0.537
Occupation	0.06	0.12	0.03	0.48	0.633
Diabetes duration	0.12	0.03	0.26	3.48	0.001
Treatment regimen	-0.006	0.15	-0.002	-0.04	0.970
Other's assistancy	2.62	0.41	0.35	6.44	0.000
Diabetes knowledge	0.05	0.11	0.03	0.50	0.616
S-TOFLA score(0-36)	-0.16	0.02	-0.60	-8.73	0.000

Discussion:

Health literacy is an important issue because limited health literacy is linked to several adverse health related variables including more hospitalization, poorer ability to take medications appropriately. Inadequate health literacy is a stronger indicator of uncontrolled diabetes and its complications. The study demonstrated that age, sex, education, occupation, diabetes duration, treatment regimen, lack of assistance for taking medications and inadequate FHL were associated with inadequate glycemic control. This study also revealed patients receiving OADs have inadequate FHL and inadequate glycemic control which corresponds with the results of Schillinger et al¹⁸ and female home maker had both inadequate FHL and inadequate glycemic control which corresponds with kim et al.¹⁹ These results corresponds with our cultural aspect as home makers have lack of information and most of the patients in our country have a fear of insulin therapy, thus they prefer OADs. Hoque et al²⁰ showed that in Bangladesh, nearly 86% of patients with diabetes have completed only high school or less as well as 62% were housewife, which corresponds with our result. Sayah et al²¹ disclosed that in a systemic review of health literacy and health outcomes in diabetes, 8 studies showed consistent and sufficient evidence of a positive association between health literacy and diabetes knowledge which did not corresponds with present study.

This study demonstrated that inadequate FHL was associated with a higher rate of inadequate glycemic control that was consistent with the study reported by Souza et al¹⁷ who studied a sample of low educated Brazilian patients in Sao Paulo using SAHLPA-18 score for measurement of FHL. Schillinger et al⁶ conducted a study with a sample of patients in San Francisco where FHL were measured by s-TOFLA and found strong association between inadequate FHL and poorer glycemic control. The proportion of patients with tight glycemic control vs inadequate control is routinely used as a quality of care indicator for diabetes. HbA1c is an objective of clinical end point that has been linked to health care use and costs and disabling and life threatening condition (Devidson, 22nd).²² After conducting a systemic review, Boren²³ suggested that a confounder could explain the inconsistency in results across studies designed to investigate the effects of health literacy on glycemic control. Significant association between FHL and glycemic control were found most of the studies that did not adjust for diabetes knowledge. Our study brought a new piece of evidence which is contrary to that hypothesis. The study was controlled for diabetes knowledge and had still found a significant association between FHL and glycemic control. In this study diabetes knowledge had no significant association with FHL (P= 0.366) as well as glycemic control (P= 0.699).

Contrary to expectations, some illiterate patients did not have inadequate glycemic control though they had inadequate

FHL. The reason might be illiterate patients were aged, thus had assistance for taking medications. In an Iranian diabetes clinic, Jahanlou and Karami²⁴ did not find a significant difference in HbA1c levels between illiterate and literate patients. Similarly, Hawthorne and Tomlinson²⁵ reported comparable levels of HbA1c between illiterate and literate Pakistani patients with type 2 diabetes. Bennett et al²⁶ demonstrated that slum and under privileged people had low level of literacy which we could not assessed because none of our patients were from that socio economic status. Jeppensen et al²⁷ found illiterate people had inadequate glycemic control which did not corresponds with our study as though a little of the participants were illiterate, they had assistance for taking medication. This study did not include a specific instrument to assess social support, which would have allowed to explore a possible interaction of this factor with FHL in determining glycemic control which different studies done.

Conclusions:

Our study indicates that the current understanding of the effect of low health literacy on health of the people with diabetes is limited. Knowledge regarding diabetes alone, however, is not associated with better glycemic control. Though, this study had a number of important implications, from the public health standpoint, these findings can inform strategic plans to address the growing diabetes epidemic.

Limitations:

It was a cross-sectional study and did not allow to ascertain whether inadequate health literacy was causally associated with poor glycemic control. The study was done among urban population where health care facilities were available and accessible but will differ in rural areas. Large scale comparative study should be carried out to see the exact situation of Bangladesh.

Conflict of interest: None.

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