

ORIGINAL ARTICLE

Level of Health Literacy Among Type 2 Diabetic Persons and its Relation to Glycemic Control

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Abstract

Introduction: Health literacy is the degree to which an individual can obtain, process, understand and communicate about health related information to make informed health decisions. Our aim was to study the influence of Diabetic health literacy in affecting the glycemic control in Diabetic patients.

Methodology: This is a Cross sectional Analytical study in 200 diabetic patients. Diabetic Knowledge Test developed by Michigan Diabetic Research and Training Center was modified after appropriate permission and was used to measure health literacy. HbA1C was used as a measure of glycemic control.

Results: In the study population, Median HbA1C was 9 gm% with Interquartile Range (IQR) of 6.10-11.80 in low health literacy group, 7.80 with an IQR of 5.95-9.32 in marginal health literacy group and 6.20 with an IQR of 5.38-7.90 in adequate health literacy group (P Value <0.001). After adjusting for socio demographic characteristics, Linear regression analysis showed that HbA1C decreased by 0.385 for every one point increase in Questionnaire score [Std.error 0.60, 95% C.I. -0.502 to -0.267, P Value <0.001]. The Odds of achieving adequate glycemic control was 0.309 in marginal health literacy group and 0.205 in low health literacy group. (95% C.I.=0.092-0.455). On applying Pearson's correlation between answer score and HbA1C, we got correlation coefficient "r"=-0.417 indicating a strong negative correlation. We also found that patients with low health literacy had higher chances of developing hospitalizations (P=0.027), Neuropathy (P=0.001) and retinopathy (P=0.049).

Conclusions: This study shows that inadequate health literacy is an independent predictor of glycemic control and complications. Development of strategies to communicate more effectively with patients who have poor health literacy are needed at the patient clinician level and the patient system level and should be based on a deeper understanding of the needs and competencies of patients with poor health literacy.

Introduction

Health literacy represents the cognitive and social skills which determine the motivation and ability of individuals to gain access to, understand and use information in ways which promote and maintain good health¹. Health literacy is a measure of patients' ability to read, comprehend, and act on medical instructions and the concept of health literacy becomes particularly important with management chronic diseases like diabetes, hypertension etc since these diseases need a better understanding by the patients². Though there is abundant

body of literature available on the importance of the concept of health literacy, there are only limited studies which measure the direct association between the level of health literacy and the outcome of chronic diseases like Diabetes or Hypertension. In spite of enormously growing researches on identifying better drugs for treatment of diabetes, little emphasis has been given by both researchers and clinicians in improving health literacy of these

patients which is very simple and cost effective. In this study, we are measuring the possible correlation between the level of health literacy in Type 2 Diabetics and its relation to the outcome of the disease.

Materials and Methods

It is a cross sectional, analytical study carried over a period of 18 months. We included 200 patients. Our inclusion criteria was, all Type 2 diabetic patients with disease duration of 5 years or more. Institutional ethical committee clearance was obtained. Newly diagnosed patients and those with renal failure, cardiac failure and stroke were excluded from the study. Patients with stroke are known to have minimal cognitive dysfunction and minimal cognitive impairment is common even in minor strokes. And also impairment in cognitive functions occurs in patients with cardiac failure and renal failure and so these patients were also excluded from the study.

Methodology

A total of 200 type-2 diabetic patients who met the appropriate selection criteria were included in the study. After obtaining informed consent, detailed history and physical examination including anthropometric measurements were carried out. The Diabetic Knowledge Test (DKT), developed by the Michigan Diabetes Research and Training center for measuring functional literacy in diabetic patients was modified and used after obtaining appropriate permissions from the Michigan University- [Grant Number P30DK092926]. The initial portion of the questionnaire which can be used both for patients on oral

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Distribution of level of literacy

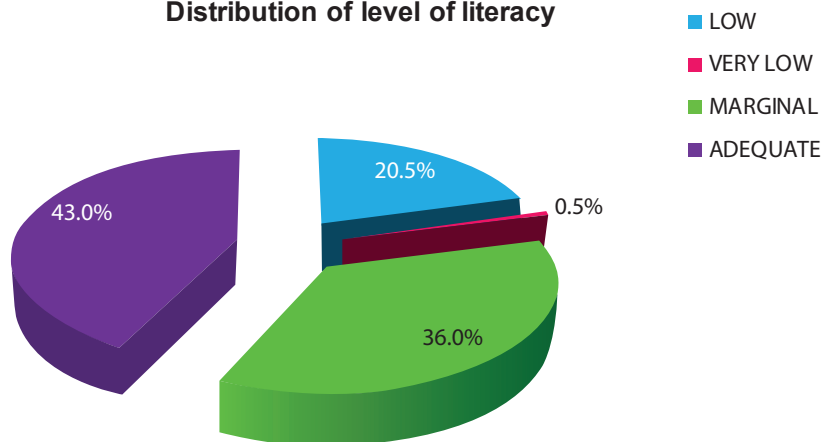


Fig. 1: Distribution of health literacy in the study population

Distribution of Level of Glycemic control

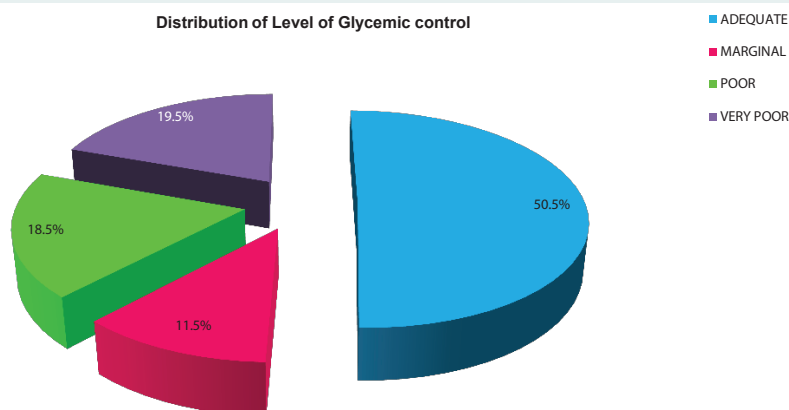


Fig. 2: Distribution of Glycemic control in study population

Table 1: Association between demographic parameters and health literacy

Variables	Level of health literacy			P Value (Chi square)
	Low	Marginal	Adequate	
Age (yrs)	56.50 ± 9.80	53.96 ± 9.18	55.02 ± 9.82	0.394
Sex				
Female (113)	25 (22.1%)	38 (33.6%)	50 (44.2%)	0.720
Male (n=87)	17 (19.5%)	34 (39.1%)	36 (41.4%)	
Literacy status				
Nil	11 (26.20%)	8 (11.10%)	10 (11.60%)	0.233
Primary	19 (45.20%)	29 (40.30%)	39 (45.30%)	
Secondary	1 (2.40%)	8 (11.10%)	8 (9.30%)	
High secondary	9 (21.40%)	20 (27.80%)	18 (20.90%)	
Graduate	2 (4.80%)	7 (9.70%)	11 (12.80%)	
Duration of diabetes	6.50 (6 - 11)	7.00 (6 - 10)	7.00 (6 - 10)	0.763

drugs or insulin was modified with certain changes to make it suitable for Indian population. It was pretested by pilot testing and all the 16 questions in the questionnaire were found to be comprehensible and yielded adequate response assuring a good internal validity with *Cronbachs alpha* of 0.76. Health literacy of the participants in relation to Diabetes was then assessed by administering the questionnaire.

6 ml of fasting venous sample of the participants was collected with strict aseptic precautions. HbA1C

was measured by Turbidometry. Blood glucose, Liver function tests, Kidney function test and lipid profile measurements were done by fully automated Analyzer AU-480 (Beckmann) Randox kits and calibrators.

Patients were divided into very low health literacy (1-3 correct responses in questionnaire), Low health literacy (4-6 correct responses), Marginal health literacy (7-9 correct responses) and adequate health literacy (10 or more correct responses) based on their answers to the questionnaire.

Patients were classified as having adequate glycemic control if their HbA1c is 7 or less, Marginal if HbA1c is between 7.1- 8, Poor if HbA1c is between 8.1-10 and very poor if HbA1c is more than 10.

Statistical Analysis

Continuous variables are presented as mean ± SD or median (IQR) if the data was skewed. Data was checked for normality before statistical analysis using Shaipro Wilk test. Normally distributed continuous variables were compared using ANOVA. Kruskal Wallis test was used for those variables that were not normally distributed (skewed distribution). Categorical variables were analyzed using the Chi Square test. Pearsons Correlation was used to measure the correlation between HbA1c and responses scored in questionnaire. Regression analysis was used to analyse the direct association between HbA1c and score in questionnaire after other characteristics were controlled. For all statistical tests, a P value less than 0.05 was taken to indicate a significant difference.

Results

The mean age of the study population was 54.95 years with a standard deviation of 9.59 years. Out of total 200 patients 113 (57%) patients were females and rest 87 (44%) were males. Mean age of females was 54.95 years with a standard deviation of 9.15 and mean age of males was 55.21 years with standard deviation of 10.18 years. There was no statistically significant association between age (One way ANOVA) of the patients or sex (Chi Square test) of the patients with their level of health literacy in our study.

Since the number of very low health literacy group was very small (0.5%), it was merged with the low health literacy group.

Demographic parameters and level of health literacy

The relationship between various demographic parameters like age and sex is given in the following table (Table 1). An important observation we got here is that the *formal literacy status of the study population did not have a significant association with the level of health literacy.*

Health literacy and glycemic control

The association between the level

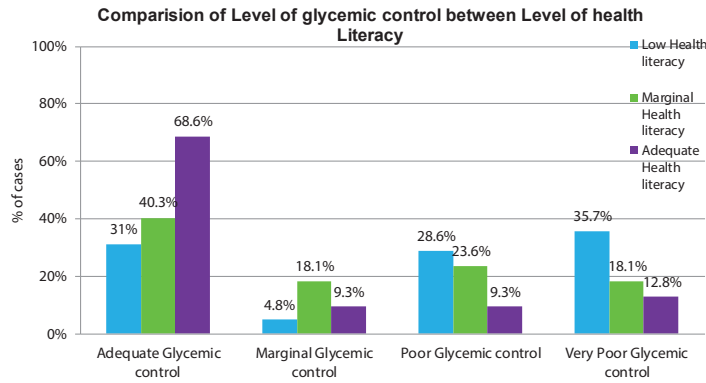


Fig. 3: Distribution of health literacy in various levels of glycemc control

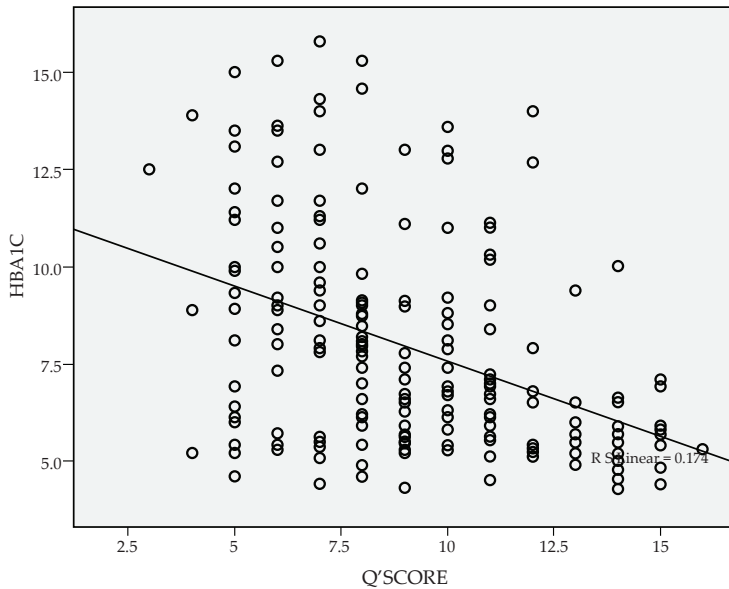


Fig. 4: Pearsons correlation between HbA1C and score in questionnaire

Table 2: Odds of achieving adequate glycemc control

Level of health literacy	N	Glycemc control		Odds ratio	95% confidence interval
		Adequate	Inadequate		
Adequate	86	59 (68.6%)	27 (31.4%)	1.000	
Marginal	72	29 (40.3%)	43 (59.7%)	0.309	0.160 - 0.594
Low	42	13 (31%)	29 (69%)	0.205	0.092 - 0.455

Table 3: Diabetic complications and health literacy

	Level of health literacy			P value (Chi square test)
	Low	Marginal	Adequate	
	Frequency/%	Frequency/%	Frequency/%	
Previous hospitalisations for DM related complications	19 (45.20%)	23 (31.90%)	19 (22.10%)	0.027
Neuropathy	18 (42.90%)	8 (11.10%)	24 (27.90%)	0.001
Retinopathy	18 (42.90%)	16 (22.20%)	22 (25.60%)	0.049

of health literacy and glycemc control was analyzed by *Chi Square test* and it was found that the glycemc control improves as the level of health literacy increases (Significance value $P < 0.001$).

The mean score in the questionnaire (DKT) gained by patients in low health literacy group was 5.33 with a standard deviation of 0.72, 7.99 in patients with marginal health literacy with a SD

of 0.813, and 12.14 in patients with adequate health literacy with a SD of 1.77.

HbA1c is a continuous variable, and it was found that the distribution of HbA1c was skewed in the study population. So median was calculated with an Interquartile Range (IQR). The median HbA1c was 9 in low health literate individuals, 7.80 in marginal

health literate individuals and 6.20 in adequate health literate individuals. Because of skewed distribution, Kruskal Wallis test was applied and it was found that there was a statistically significant relationship (P Value < 0.001) between health literacy and glycemc control.

Total number of questions answered correctly by the patient (Q Score) and their HbA1C levels, both are absolute numbers (Continuous Variables). So the correlation between HbA1C and the Q Score was assessed with the help of Pearsons Correlation. We found that there is a strong negative correlation between HbA1c and the Q Score. Pearson Product Moment Correlation (PPMC) coefficient "r" was -0.417. It indicates a strong negative correlation. The correlation is statistically significant. (P Value < 0.001).

Since HbA1c and the scores in the questionnaire are both continuous variables, we applied linear regression analysis to study the relationship between them after adjusting for socio-demographic characteristics. The linear regression coefficient (Beta) was "-0.385", which means that for every one point increase in the Questionnaire score, HbA1c decreased by 0.385 [Standard error of coefficient Beta was 0.060 and 95% confidence interval of Beta was "-0.502 to -0.267"]. Statistical significance (P Value) of the regression was < 0.001 .

Odds of achieving adequate glycemc control was analysed in various levels of health literacy. It was found that patients with low health literacy were less likely to achieve adequate glycemc control (HbA1C < 7 gm%) than patients with adequate health literacy. (Odds Ratio-0.205, 95% C.I.=0.092-0.455).. It was also seen that patients with marginal health literacy were less likely to achieve adequate glycemc control than patients with adequate health literacy (Odds Ratio 0.309, 95% C.I.= 0.160-0.594).

Diabetic complications and health literacy

On studying the association between complications of Diabetes and health literacy, we found that the hospitalizations for various diabetes related complications increased as the level of health literacy decreased. The level of health literacy also had significant impacts on the development

of neuropathy and retinopathy. The results are depicted in Table 3.

The association between health literacy and compliance of the patients to various advices given in clinic was analyzed by *Chi Square Test*. It was found that, there exists a statistically significant association between the level of health literacy and the compliance with physician's advice. Patients with low health literacy were more likely to be less compliant with diet than marginal or adequate health literacy (P value- 0.002). Also patients with low health literacy fails to perform adequate exercises than persons with good health literacy (P value <0.001). Patients with low health literacy were also found more likely to be less compliant with their medications prescribed (P Value <0.001).

Discussion

Health literacy is defined as, "The degree to which individuals can obtain, process, understand and communicate about health-related information needed to make informed health decisions." Patients with poor health literacy not only have limitations in reading labels on a pill bottle or interpreting blood sugar values or dosing schedules or comprehending appointment slips, but also may have difficulties in processing oral communication and conceptualizing risk.^{3,4} In the context of a health care system in which scientific advances and market forces place a greater technical and self-management demands on patients, poor health literacy may be a particularly important barrier to chronic-disease care. Low health literacy has been consistently associated with worse diabetes knowledge in a variety of settings including ambulatory and hospitalized older patients.^{5,6}

The International Diabetes Federation (IDF) estimates the total number of diabetic subjects to be around 40.9 million in India and this is further set to rise to 69.9 million by the year 2025⁷. Schillinger *et al*⁸ reported that inadequate health literacy was associated with nearly twofold increased odds of poor glycemic control compared with adequate health literacy (adjusted odds ratio: 2.03; 95% CI: 1.11–3.73; p = 0.02). Strategies to minimize the hazards of this growing epidemic

should include promotion of health literacy.

Recognizing that low health literacy is common and associated with many facets of diabetes care – including important outcomes – strategies to address health literacy should be developed, tested and promoted. The foundation of these strategies rests with the principles of clear health communication, including assessment of understanding, use of plain language, emphasizing few key points and using effective printed materials.⁹ As advocated by ADA in its position statement in January 2015,¹⁰ patient-centered communication style that incorporates patient preferences, assesses literacy and numeracy, and addresses cultural barriers to care should be used. Considering low health literacy, the American College of Physicians Foundation (ACPF) developed the 'Living with Diabetes Guide' as a resource for patient education and also to promote goal setting and shared decision making in diabetes care.^{11,12}

This study throws light upon the importance of health literacy in management of diabetes mellitus. For health care professionals, the prevalence of poor health literacy and the strength and consistency of the association between health literacy and diabetes outcomes should serve as a call to action. Development of strategies to communicate more effectively with patients who have poor health literacy are needed at the patient-clinician level,¹³ and the patient-system level¹⁴ and should be based on a deeper understanding of the needs and competencies of patients with poor health literacy.

Recommendations and Conclusions derived from this study

- The results of this study shows that, there is an urgent need for incorporating programs to improve health literacy in Diabetic management programs to overcome the devastating consequences of this disease.
- For the health care providers, this study reminds about the importance of imparting proper education to the patients in addition to the medications.

- For the Government and policy makers, this study tells the need of incorporating health literacy in school education. This can reduce the incidence of chronic diseases as a whole and improve the well being of the society, improve their productiveness, reduce the cost spent in health care and can improve the GDP of the Nation.
- Direct involvement of patients in developing educational materials may empower them to improve their health, while assuring that the content effectively educates them.
- Research to develop effective office-based communication strategies and efforts to more widely apply chronic-disease management programs for patients with poor health literacy should be supported.

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