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Viewpoint

Spoken knowledge in low literacy diabetes scale: Reliability and validity assessment on Indian Type 2 diabetes patients

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ABSTRACT

India is facing a diabetes epidemic and it urgently needs to address the health literacy needs of diabetes patients to reduce the catastrophic impact of the disease. Since a valid and reliable tool for assessing diabetes literacy assessment was lacking, this study was carried out to conduct a psychometric analysis of the Spoken Knowledge in Low Literacy Diabetes (SKILLD) Scale among Indian Type 2 diabetes patients. The study participants belonged mostly to the lower socioeconomic strata with low literacy. The results of the Kannada version of the SKILLD scale administered to 100 Type-2 diabetes patients visiting a tertiary care center in South India are presented here.

Keywords: Low literacy, Type-2 diabetes, Psychometric analysis, India

INTRODUCTION

A dual problem exists in diabetes management, which is a lack of diabetes literacy among patients[1,2] and the inability of patients to understand physicians' instructions.[3,4] This results in poor diabetes outcomes. Diabetes literacy assessments are now mandatory at the initial stages of patient evaluation as a way of ensuring the quality of diabetes care.[5] However, the treating physician will need a tool that can be used to assess patients' knowledge and ability to follow diabetes related instructions.

THE STUDY INSTRUMENT

The Spoken Knowledge in Low Literacy Diabetes (SKILLD) was developed by Rothman *et al.*[6] to aid in the assessment of diabetes literacy among low literacy patients. The 10-item SKILLD assesses core knowledge related to self-care, including glucose management, appropriate lifestyle modifications, the recognition and treatment of acute complications, and appropriate activities to prevent long-term consequences of uncontrolled disease. Each item carries 10 points. The total score ranges from 0% to 100%. A total SKILLD score of >50% indicated good diabetes literacy. The expected response for each item was derived from the new American Diabetes Association (2020) standards for diabetes care[5] [Table 1].

This study was undertaken to conduct a psychometric assessment of the SKILLD Scale among Kannada speaking Type-2 diabetes patients in South India and to ascertain the socio-clinical correlates of diabetes. Inclusion criteria were Type-2 diabetes patients with a history of diabetes for at least 6 months and age 20 years or older.

PROCESS OF PSYCHOMETRIC ANALYSIS

The English version was translated into the Kannada version by back translation procedures by two social scientists as per the Brislin translation model[7] after obtaining necessary permission from the authors. Knowledge scores were compared with the patient's education level and a clinical parameter related to glycemic control. Those with $HbA_1c \leq 7\%$ are considered to have good glycemic control in this study.

RELIABILITY AND VALIDITY RESULTS

Kuder-Richardson coefficient was 0.73 (0.66–0.81, 95% CI), indicating good reliability of results. The item total correlation ranged from 0.25 to 0.56. The mean total SKILLD score was 44.6% (SD=14.71, SE_M=1.47, Range−0–65%, 95% CI).

Factor analysis

Kaiser-Meyer-Olkin measure was 0.76 and Bartlett's test showed the adequacy of sample size ($\chi^2 = 197.752$, df = 45, $P < 0.0001$), suggesting that the dataset was fit for factor analysis. Principal component analysis with Promax rotation revealed three-factor structure with Eigenvalue >1 and explained 31.7%, 46.8%, and

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Table 1: Diabetes knowledge on 10 items of SKILLD (*n*=100).

Questions (Score-0 or 10 for each)	Good knowledge *(*n*=100)	Median SKILLD Score	*P*-value[¥]
What are the signs and symptoms of high blood sugar? How do you feel when your blood sugar is high or when you were diagnosed?	77	10	**0.002**
What are the signs and symptoms of low blood sugar? How do you feel when your blood sugar is too low?	84	10	0.14
How do you treat low blood sugar? What should you do if your sugar is too low? How can you bring your blood sugar up if it is too low?	42	5	0.21
How often should a person with diabetes check his or her feet? Once a day, once a week, or once a month?	63	5	0.48
Why are foot exams important in someone with diabetes? Why is it important to look at your feet? What are you looking for?	47	5	**0.01**
How often should you see an eye doctor and why is it important? How often? Why?	34	0	0.79
What is a normal fasting blood glucose or blood sugar? When you get up first thing in the morning and check your blood sugar before you eat or take medicine, what should it be? What 2 numbers?	57	5	**0.002**
What is a normal HbA1c (hemoglobin A1C) or "average blood sugar test"? When they draw blood from your arm and get an average blood sugar reading, what should it be?	13	0	0.32
How many times per week should someone with diabetes exercise and for how long? How many times a week? How long or how much per day?	63	5	0.61
What are some long-term complications of uncontrolled diabetes? Do you know anyone that has diabetes and had "bad things" happen to them? What are some of those "bad things"?	81	10	0.14
Overall Good Knowledge	50	50	**0.03**

*Good knowledge Score >50% [¥]2-tailed Mann-Whitney U Test for difference in mean score of education level >6th grade (*n*=66) and ≤6th-grade (*n*=34). Boldface *P* values are statistically significant

57.4% total variance, respectively. The theoretical constructs of the three factors are identified as Factor 1: Knowledge related to treatment and self-care. (Items – 3, 4, 6, 9, and 10), Factor 2: Knowledge related to diagnosis of diabetes related signs and symptoms (Items – 1, 2, and 5), Factor 3: Knowledge related to diabetes numeracy for blood sugar monitoring, that is, the normal value of fasting blood sugar and HbA_1c (Items 7 and 8). However, the subscale reliability coefficient for these three factors was low at 0.65, 0.67, and 0.45, respectively. The original study had reported only one factor structure.[6]

Construct validity

The mean Total SKILLD score was higher (54.95%) among the higher education category compared to those with less than 6th Standard education (41.87%) and it was statistically significant at $P = 0.03$ as shown in [Table 1]. Further, a significant correlation was found between total SKILLD scores with education (r = 0.41, 0.2–0.6, 95% CI, $P < 0.001$) and income categories (r = 0.25, 0.01–0.47, 95% CI, $P = 0.02$). ANOVA revealed significant difference in education level and SKILLD scores (0 = No knowledge, 5 = partial knowledge, and 10=good knowledge), ($F_{(1,98)} = 7.20$, $P = 0.009$). The eta squared was 0.07 indicating the education levels explain approximately 7% of the variance in SKILLD scores. *Post hoc* paired *t*-test Tukey pair-wise comparison showed that mean SKILLD scores were higher (>50%) among higher education category (Mean=47.35, SD=12.47, $n = 66$) was significantly larger than for lower education category (M=39.26, SD=17.28, $n = 34$) at $P = 0.009$.

Table 2: Comparison of SKILLD categories with socio-clinical variables.

Variable	SKILLD score		*P*-value
	Low knowledge ≤50	Good knowledge >50	
HbA_1c			
≤ 7%	20	12	0.64
> 7%	40	23	
Duration of diabetes			
< 5 years	26	17	**0.005**
> 5 years	38	19	
Gender			
Female	37	19	**0.006**
Male	27	17	
Education			
Up to 6th Standard	25	9	**<0.001**
Higher	39	27	
Income			
< Rs 10,000	44	23	0.64
> Rs10,000	20	13	
BMI			
Normal	12	6	**0.005**
High	52	30	
HDL: Cholesterol Ratio			
Normal	8	3	**0.02**
High	17	11	
Type of Medication			
Oral	48	30	**<0.001**
Both Oral and Insulin	16	6	

*Chi-square test, df=1 Boldface *P* values are statistically significant

[Table 2] shows that there was no significant difference in knowledge level when compared with HbA1c ($\chi^2_{(1)} = 0.21$, $P = 0.64$) and income ($\chi^2_{(1)} = 0.21$, $P = 0.64$). However, there

was significant difference in diabetes knowledge level and was found in relation to duration of diabetes ($\chi^2_{(1)}$ = 8.02, P < 0.005), gender ($\chi^2_{(1)}$ = 7.41, P < 0.006), level of education ($\chi^2_{(1)}$ = 18.75, P < 0.001), BMI ($\chi^2_{(1)}$ = 77, P = 0.005), HDL: Cholesterol ratio ($\chi^2_{(1)}$ = 9.80, P = 0.02), and type of medication ($\chi^2_{(1)}$ = 32.67, P < 0.001).

Concurrent validity

There was a low negative correlation between HbA_1c level and total skilled score (r = 0.01, −0.21 and 0.19, 95% CI) but not statistically significant (P = 0.94) which might be because the majority of the patients (63%) in this study had poor glycemic control (HbA_1c >7%). Chi-square goodness of fit test revealed that patients with low SKILLD scores had significantly higher HbA_1c than expected [$\chi^2_{(1)}$ = 6.67, P < 0.01].

PATIENT EDUCATION AND KNOWLEDGE EVALUATION

Low literacy is still widely prevalent in India,[8,9] which means that there are substantial numbers of people who might not be able to understand physicians' instructions and contributing to poor diabetes outcomes. Studies from India also concur that the diabetes-related morbidities and mortalities are attributed to poor diabetes literacy.[9,10] This study results also confirm that the majority of the patients did not have information on diabetes self-care. Item 7 and Item 8 on SKILLD scale captured numeracy skills deficit related to normal fasting blood glucose and HbA_1c levels which are critical in diabetes self-care practices.[5,6] Researchers can use this instrument to gather more data on numerical skills among patients. However, the SKILLD scale does not have items related to knowledge of nutrition and diabetes medication. It does measure most of the skills necessary for daily self-care. The tool will help both physicians and patients to empower themselves with the necessary health information needed to improve the quality of diabetes care.

The tool could clearly define the areas of knowledge deficit and help in patient education interventions. The SKILLD tool can be used both as a diagnostic tool as well as an evaluation tool in diabetes health literacy. India is a country with linguistic and cultural diversity. Therefore, psychometric analysis of this instrument in other Indian languages and in various settings and on a larger population is required to gather more evidence.

Limitations

This study being a cross-sectional study test-retest reliability analysis could not be done.

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Declaration of patient consent

Institutional Review Board (IRB) permission was obtained for the study.

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Conflicts of interest

There are no conflicts of interest.

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