

Health Literacy Measurement Tool for Patients with Type 2 Diabetes Mellitus in Thailand

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Abstract

Background: The health literacy (HL) measurement tools have been various and not yet standardized.

Objectives: To investigate the properties of HL measurement tool for patients with type 2 diabetes mellitus (T2DM).

Methods: A cross-sectional study was conducted among 620 T2DM. Participants were interviewed about the 62 health literacy items in three domains: (a) reading medical terms; (b) numeracy test; and (c) decision making. The data were collected from January to April 2019. The reliability, discrimination, and difficulty are examined using the Kuder-Richardson Reliability Coefficient (KR-20), indices of discrimination and difficulty.

Results: The study found 49.8% aged older than 60 years, 80.2% had primary education level and 72.4% received no insulin injections. The properties of the HL measurement tool were (1) the reliability is excellent level for medical terms (KR-20 = 0.98) and good levels for both numeracy test and decision making (KR-20 = 0.72 and 0.79, respectively); (2) The index of discrimination are high for both medical terms and decision making ($r = 0.58 - 0.80$ and $0.48 - 0.55$, respectively) but low level for the numeracy test ($r = 0.02 - 0.43$); (3) The indices of difficulty are high level for medical terms and decision making ($p = 0.45 - 0.70$ and $0.73 - 0.76$, respectively) but low level for numeracy test ($p = 0.02 - 0.64$).

Conclusions: The 62-item tool is considerably good to measure HL for patients with type 2 diabetes regarding its reliability, discrimination, and difficulty. However, the numeracy test should be more developed to the discrimination and difficulty.

Keywords: Health Literacy, Health Literacy Measurement Tool, Type 2 DM

Introduction

Health literacy (HL) is a substantial driver to build empowerment and increase individual capacity [1] and plays a very crucial role in self-management such as those patients with chronic diseases [2]. Previous studies revealed that HL has a negative association with physical inactivity, unhealthy food consumption, low body mass

index (BMI), and obesity [3]. Similarly, diabetic patients with sufficient functional HL can answer questions about the knowledge of diabetes correctly more than those with insufficient functional HL [4].

The HL measurement tools have been widely discussed [5] and not yet standardized. Moreover, HL measurement tools have been various. It is mostly used for functional HL measurement. In Thailand, the HL measurement tool was developed in 2015 by the Health Education Division, the Ministry of Public Health [6]. But there are still some limitations. Firstly, it has a low level of both reliability and index of discrimination especially in the critical HL domain (KR-20 = 0.49 and

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$r = 0.20-0.38$, respectively). Although the numeracy test for functional HL having a good level of reliability ($KR-20 = 0.82$) but the questions are designed by pairing the terms of physical examinations (blood pressure, blood glucose, BMI, etc) with several values of each term. This could only measure the memory ability of the patients. Lastly, the patient takes a long time to answer questions with an average of more than 30 minutes due to a high number of questions to measure functional HL even it had a good level of reliability ($KR-20 = 0.98$).

Thus, the properties of HL measurement tool were recently revised regards its reliability, discrimination, and difficulty to appropriately measure the HL for patients with type 2 diabetes.

Objectives

This study aimed to investigate the property of HL measurement tool for T2DM patients.

Materials & Methods

This cross-sectional study was conducted in Nakhon Ratchasima province, Thailand. this tool applies from HL measurement tool of the Health Education Division, Ministry of Public Health [6] to better measure HL about its reliability, discrimination, and difficulty. The revision of this tool had several steps including 1) reviewing previously published literature to consider the conceptual framework; 2) identifying substantial parameters that affect the HL of the patients including gender, age, marital status, educational attainment, duration of having diabetes; 3) improving the questions to ensure that there are precise and easily understandable; and 4) performing data collection.

The sample size was calculated by using the ratio of 1 question per 10 subjects [7], therefore, this study had 620 subjects for 62 questions in total. These subjects were from 8 health service centers including 4 from primary and secondary care levels equally. The consecutive sampling method [8] was conducted at these health service centers. The patients who met the inclusion criteria were selected considering the sequent orders of accessing health services.

Inclusion criteria

1. Patients with T2DM who are diagnosed by

physicians.

2. Age of 20 years or older.
3. Without mental disorders
4. Being able to read and write.

Exclusion criteria

1. Elderly aged 60 or older who extensively need care for their daily activities.
2. Dementia patients.

Questionnaire and measurements: The revised 62-item HL measurement tool composes of (1) There are 44 medical terms, which reduced from 66 items. The 22 terms were excluded due to its similarities to those 44 terms in terms of meanings, difficulty, and level of the index of discrimination, index of difficulty, and factor loadings altogether. (2) There were 14 items for the numeracy test, which translated from the Diabetes Numeracy Test (DNT) [9]. (3) There were four items of decision-making test.

Within the scoring system for all domains, the patient received 1 point when they are answering each question correctly and 0 points if they answered incorrectly. The value of the reliability greater than 0.80 is considered as a particularly good level [10, 11]. The index of discrimination (r) of 0.40 and higher is considered as a high level but less than 0.2 is as low level [12, 13]. The index of difficulty of between 0.2 and 0.80 is as good level [13].

Statistical analysis: Data from the subjects were collected between January and April 2019. Descriptive statistics including frequency, percentage mean and standard deviation were used to describe the study's results regarding gender, age, marital status, educational background, duration of diabetes, and insulin injection. The reliability (Kuder-Richardson reliability Coefficient; $KR20$), the indices of discrimination (r), and difficulty (p) were calculated.

Results

Patient characteristics: This study found 76.1% of the patients were females, 49.8% ($\bar{X} = 60.3$, $SD = 9.8$) aged more than 60 years, 79.7% were married, 80.2% had primary education level, 37.7% were those having

the duration of diabetes less than 6 years ($\bar{X}=8.6$ SD= 6.5), and 72.4% never have insulin injection. (not shown in table)

Reliability, Discrimination, Difficulty Indices

The reading medical term set 1 had very good level for the reliability (KR-20 = 0.98), high level for the index of discrimination ($r = 0.59 - 0.74$), and good level for the index of difficulty ($p = 0.47 - 0.70$) (Table 1).

Table 1 Reliability, Discrimination, and Difficulty of medical vocabulary set 1 (N=620)

Item	Index of discrimination (r)	Index of difficulty (p)
1. Value	0.62	0.56
2. Retina	0.61	0.68
3. Control	0.59	0.69
4. Jogging	0.74	0.52
5. Grape	0.63	0.68
6. Meditation	0.67	0.66
7. Hemodialysis	0.67	0.65
8. Candy	0.64	0.68
9. Teaspoon	0.68	0.65
10. Ophthalmologist	0.63	0.47
11. Paralysis	0.69	0.63
12. Bike	0.60	0.70
13. Drug allergy	0.59	0.69
14. Blood pressure	0.63	0.68
15. Evaluation	0.60	0.70
16. Kidney failure	0.66	0.63
17. Unconscious	0.63	0.68

Kuder-Richardson's reliability Coefficient was 0.98 for the total scale.

The reading medical term set 2 had very good level for the reliability (KR-20 = 0.97), high level for the index of discrimination ($r = 0.58 - 0.80$), and good level for the index of difficulty ($p = 0.45 - 0.70$) (Table 2).

Table 2 Reliability, Discrimination, and Difficulty of medical vocabulary set 2 (N=620)

Item	Index of discrimination (r)	Index of difficulty(p)
1. Balance	0.67	0.63
2. Coffee spoon	0.61	0.61
3. Monosodium glutamate	0.58	0.70
4. Chest x-ray	0.80	0.52
5. Identification book	0.63	0.67
6. Body mass index	0.74	0.45
7. Foot pulse	0.75	0.57
8. Capillary	0.70	0.65
9. Palm oil	0.63	0.67
10. Chicken and shrimp soup	0.69	0.61
11. Skim milk	0.68	0.51
12. Complications	0.70	0.60
13. Consumer unit	0.68	0.65
14. Risk factors	0.70	0.64

Kuder-Richardson's reliability Coefficient was 0.97 for the total scale.

The reading medical term set 3 had a very good level for the reliability (Kr20 = 0.96), high level for the index of discrimination (r 0.62 - 0.80) and good/very good for the index of difficulty (p 0.45 - 0.65) (Table 3).

Table 3 Reliability, Discrimination, and Difficulty of medical vocabulary set 3 (N=620)

Item	Index of discrimination (r)	Index of difficulty(p)
1. Cholesterol level	0.74	0.45
2. Nutrition flag	0.70	0.57
3. Chocolate	0.80	0.52
4. Sodium	0.80	0.52
5. Crisis	0.78	0.49
6. Operating	0.69	0.64
7. Ischemic heart disease	0.67	0.63
8. Capillary in eyes	0.69	0.49
9. Protein in urine	0.72	0.62
10. Electrocardiogram	0.69	0.58
11. Blood concentration	0.73	0.54
12. Anticoagulants	0.73	0.58
13. Blood sugar after meals	0.62	0.65

Kuder-Richardson's reliability Coefficient was 0.96 for the total scale.

The numeracy test had a good level for the reliability (KR-20 = 0.72), relatively low level of both the index of discrimination (r 0.02 – 0.43) and the index of difficulty (p 0.01 - 0.64) (Table 4).

Table 4 Reliability, Discrimination, and Difficulty of numeracy test (N=620)

Item	Index of discrimination (r)	Index of difficulty (p)
1	0.43	0.33
2	0.35	0.64
3	0.35	0.59
4	0.44	0.56
5	0.33	0.22
6	0.15	0.11
7	0.30	0.49
8	0.21	0.27
9	0.06	0.03
10	0.44	0.32
11	0.06	0.04
12	0.02	0.01
13	0.07	0.05
14	0.07	0.04

Kuder-Richardson's reliability Coefficient was 0.72 for the total scale.

The decision-making test had a good level of reliability (KR-20 = 0.79), a high level of the index of discrimination (r 0.48 – 0.55), and a good level of the index of difficulty (p 0.73 - 0.76) (Table 5).

Table 5 Reliability, Discrimination, and Difficulty of decision (N=620)

Item	Index of discrimination (r)	Index of difficulty(p)
1	0.50	0.75
2	0.53	0.73
3	0.48	0.76
4	0.55	0.73

Kuder-Richardson's reliability Coefficient was 0.79 for the total scale

Discussion

This study found that it was the first evidence on the improvement of the HL measurement tool in Thailand. Overall, this new 62-item tool is good and applicable regarding its reliability, discrimination, and difficulty as following discussed.

Reliability:

- 1) The total of 44 items using for measuring

functional HL is a very good level (KR-20 = 0.98, not shown on the table). All the medical term sets 1, 2, and 3 had very good levels. Moreover, this new tool is proven to be more efficient than the previous version. This is because it takes only 3-5 minutes to measure functional HL. Also, it is very applicable to measure HL among patients with T2DM in Thailand. Importantly, health professional uses the tool to evaluate the patient quickly and provide appropriate cares to the patients regarding their level of HL. Besides, care providers or health

professional can have more time to provide services for others who are in need. Our new tool is like the Rapid Estimate of Adult Literacy in Medicine (REALM). REALM is widely used to measure functional HL among the patients with T2DM to screen and identify patients considering their ability to read and pronounce medical terms. After that, supportive media and appropriate consultative approaches are needed to provide care for patients with low HL [14,15]. This is also like Medical Achievement Reading Test used to measure functional HL with 42 medical terms, within 3-5 minutes [16].

2) The numeracy test had a good level of reliability. This is different from DNT15 which had an excellent level.^[9] This is because the patients with T2DM in Thailand mostly had only a primary education level. So, they had low mathematic skills leading to low ability to answer questions.

3) The making decision test had the reliability at a good level, which was better than the previous version. This is because the questions were adjusted to be more understandable, so, the patients can answer questions correctly.

Discrimination

The medical terms had the index of discrimination at high levels. Moreover, the index of discrimination of the decision-making increases to a high level from the previous version ($r = 0.20 - 0.38$). But a quite low level for the numeracy test.

Difficulty

The medical terms had a good level of the index of difficulty. The index of difficulty of the decision making increased to a good level compared to the previous version. The numeracy test had a low level. This is because most of the T2DM were elderly and most had only a primary education level. These questions were probably too difficult to understand. They were less able to calculate some medical numbers about nutrition intake, exercise, blood glucose, and medication. Therefore, mathematical skills are required because these questions are quite complicated and difficult to understand. For example, they needed to calculate carbohydrate intake from daily food consumption and food packaging, food demand for a certain exercise, the use of strips for test

blood sugar because these were performed by the health professional. In general, blood samples from patients with T2DM in Thailand were collected about once a month while seeking care at health care centers to test the blood sugar levels by health staff/caregivers. This situation indicates that patients do not understand how to use the strips for blood sugar tests unlike in some countries. In some countries, this could be easier for patients to perform these by themselves. Similarly, in the case of the medication calculation, they are required to calculate the unit of insulin for injection and medical drug uses when the patients' blood level changes. Normally, the health professional is responsible to perform this process, adjust, and consider the unit of insulin and medical drug use. Therefore, the patients are unfamiliar with these domains. This supports the finding of this study that revealed only 27.6% of patients who had insulin injections. This is unlikely to other countries where the patients could adjust the unit of insulin and medical drug use by themselves.

Conclusions

The 62-item tool is considerably good to measure the HL for patients with T2DM regarding its reliability, discrimination, and difficulty. However, the numeracy test should be more developed to the discrimination and difficulty and more applicable in the Thai context.

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Conflict of Interest: none

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