

## Development and Evaluation of a Turkish Scale to Assess Medication Literacy for Adults

**Short title: Medication Literacy Scale For Adults**

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24.03.2022

05.05.2022

15.05.2022

### ABSTRACT

**Objectives:** The objective of this study was to develop a Turkish scale to assess medication literacy and evaluate its psychometric properties among adults having at least 12 years of education in Turkey.

**Materials and Methods:** After the composition of a preliminary set of items, the content validity of the scale was assessed by an e-Delphi process and a pilot study. The psychometric properties of the scale were evaluated in 358 participants who had above 12 years of education; university students, academic and administrative staff from two faculties (pharmacy, law) in two universities (Marmara University and Ankara University) located in two different cities (Istanbul and Ankara) in Turkey between March 2021 and May 2021. The test-retest validity was assessed by Spearman's rho and Wilcoxon test). Internal consistency was evaluated by Kuder Richardson 20. Principal component analysis was conducted.

**Results:** The last version of the medication literacy scale consisted of 8 items. There was a positive correlation (Spearman's rho=0.570;  $p<0.01$ ) and no significant difference ( $p=0.308$ ) between the scores of the scale at baseline and after a two-week interval. Kuder Richardson 20 coefficient was 0.659. Students and graduates of health sciences had significantly higher scores on the medication literacy scale when compared to participants who did not have any education in health sciences (the median [25<sup>th</sup>-75<sup>th</sup> percentiles]: 8.0 [8.0-8.0] vs 7.0 [6.0-8.0], respectively;  $p<0.001$ ).

**Conclusion:** The Turkish version of MEdication LIteracy Scale for Adults (MELSA-TR) is a valid tool to evaluate medication literacy among adults who have above 12 years of education

in Turkey. Still the generalizability of our findings should be evaluated with caution since this study was conducted in a sample with a significant representation from healthcare professionals. It would be useful to conduct further studies evaluating the psychometric properties of this scale in participants with diverse characteristics.

**Keywords:**

Medication literacy, scale, clinical pharmacy, validation, measure, MELSA-TR

**INTRODUCTION**

Medication literacy is defined as “the degree to which individuals can obtain, comprehend, communicate, calculate, and process patient-specific information about their medications to make informed medication and health decisions in order to safely and effectively use their medications, regardless of the mode by which the content is delivered (e.g., written, oral and visual)”<sup>1</sup>.

Medication literacy is essential for enabling individuals to safely use unprescribed medications, herbal products, and dietary supplements in addition to prescribed medications.<sup>2</sup> Individuals with poor medication literacy could improperly manage their medications, leading to medication-related problems, including medication adherence.<sup>3</sup> Promoting individuals' capability towards rationale medication use is crucial to avoiding potential medication-related problems.

A medication literacy scale, which is designed to evaluate the counselling and educational needs of healthy individuals in primary care (such as community pharmacies) and clinical settings, should be valid and reliable, as well as not time-consuming and easily applicable. Worldwide, there are only a few specific tools or scales for measuring medication literacy.<sup>4-5</sup> The Recognition and Addressing of Limited Pharmaceutical Literacy (RALPH), developed by Vervloet et al.<sup>6</sup>, is an interview guide for pharmacists in identifying the individuals with limited medication literacy implicitly. The RALPH interview guide determines medication literacy by asking questions about the medications used by the patient. However, this scale is not applicable to healthy individuals who do not use medication regularly.<sup>7</sup> There are also other scales that are constructed based on vignette scenarios and medication leaflets and instructions.<sup>2,8-10</sup> Vignette-based questions with instructions assess individuals' understanding and interpretation of medication information. However, vignette-based scales are mostly composed of questions specific to the health system of the country where the scale had been developed<sup>2,8</sup>, so they are not suitable for cultural adaption.

In Turkey more than half of the adults have inadequate or limited health literacy levels. This problem is apparent also among participants who are university graduates and/or who have a higher educational level (<https://sggm.saglik.gov.tr/Eklenti/39699/0/soya-rapor-1pdf.pdf>). Still there is currently no Turkish scale to evaluate individuals' medication literacy levels. The objective of this study was to develop a scale of medication literacy in Turkish (MEDication Literacy Scale for Adults: MELSA-TR) and evaluate its psychometric properties among adults having at least 12 years of education (including Turkish university students, academic and administrative staff) in Turkey.

**METHODS**

***Ethical Approval***

Ethical approval for this study was received from Marmara University, Institute of Health Science Ethical Board Committee, Istanbul, Turkey (Date: 14/09/2020; File number:77).

Participants provided electronic informed consent to participate in the study.

The study was reported based on the recommendations of the COnsensus-based Standards for the selection of health status Measurement INSTRUMENTS (COSMIN) statement.<sup>11</sup> The study design is presented in Figure 1.

***Composition of a Preliminary Set of Items***

The scale items were developed in the light of the literature.<sup>2,9,12-13</sup> The research team also reviewed drug leaflets and patient education brochures to generate the items. As the first version of MELSA-TR, twenty-seven draft items were created with virtual medicine boxes and instructions. Both performance-based (such as calculation) and perception-based (interpretation of instructions given) items related to prescribed medications/ nonprescribed medications/ dietary supplements/ herbal medicines were included. These items were created based on numeracy, prose, and document literacy.<sup>2</sup> Each item of the scale had a dichotomous score (1: for the correct response and 0: for the wrong response and 0 for the option of no idea/don't know).

#### ***e-Delphi Process***

The content validity of the scale was assessed by an e-Delphi process between December 2020 and February 2021. A national multidisciplinary group of experts working on health literacy (including community pharmacists, hospital pharmacists, a health sociologist, a clinical psychologist, a public health expert, nurses, a pharmacologist, clinical pharmacists, physicians, a pedagogist, and an education specialist) participated in the e-Delphi process. A link to the online survey was generated on Marmara University Questionnaire System, which is powered by Lime Survey<sup>®</sup> and invitation letters were sent to the experts by email. After receiving their informed consent electronically, the questionnaire link was sent individually with a password. The participants were asked to complete the questionnaire within three weeks.

The experts were asked whether the items would be relevant to medication literacy. The experts rated each item with a 4-point Likert scale (from very irrelevant [1] to very relevant [4]) and provided suggestions and comments to evaluate the clarity and comprehensibility of the questions (about the type, visual, and grammar of the items) by filling in the comment box for each item. At the end of each round, the Content Validity Ratio (CVR) and the Content Validity Index (CVI) were calculated for each item.<sup>14</sup> If the item-CVI was less than 0.70, the item was excluded from the scale. If the item CVI was in the range of 0.70-0.79, it was revised. If the CVR value of the item was negative, it was excluded from the scale.<sup>15</sup>

Two separate rounds were conducted within four weeks interval for the e-Delphi study. Thirty-six experts from various disciplines were invited to the e-Delphi study. Thirty experts participated in Round 1. At the end of Round 1, four items in the scale were excluded based on the CVR and CVI findings. The items were re-written according to the feedback and suggestions of the experts. Twenty-six experts participated in Round 2. No items were excluded, and no other items were added to the scale at Round 2, and the second version of MELSA-TR consisted of 23 items.

#### ***Pilot Study***

A pilot study was carried out on 30 adults (a separate sample of individuals who were recruited neither in the test-retest nor the psychometric study) for the second version of MELSA-TR. The participants assessed the comprehensibility of the items. It took an average of 10-15 minutes to complete the scale. The readability of the total scale was evaluated by the Turkish evaluation formula, which was developed by Atesman et al.<sup>16</sup>, and it was found as average, with a score of 65.3.

#### ***Assessment of the Psychometric Properties of the Scale***

The online survey was conducted between March 2021 and May 2021. The sample size for validation studies is recommended to be ten times the number of items in the scale, so it was calculated that at least 300 participants would be required for an adequate sample size.<sup>17</sup> The study population consisted of university students, academic and administrative staff from two faculties (pharmacy, law) in two universities located in two different cities (Istanbul and Ankara) in Turkey. Because of the restrictions (including a curfew and social distance) during the COVID-19 pandemic, an online survey was conducted in both Delphi processes

and the psychometric analysis. Due to the difficulties in reaching individuals with low education levels, this study was conducted only on individuals with an education level of above 12 years using convenience sampling. In Turkey, the compulsory education year has been 12 since 2012 (<https://www.resmigazete.gov.tr/eskiler/2012/04/20120411-8.htm>). The population of this study had a medium to high level of education according to the International Standard Classification of Education (ISCED)

([https://ec.europa.eu/eurostat/statistics-explained/index.php?title=International\\_Standard\\_Classification\\_of\\_Education\\_\(ISCED\)#Implementation\\_of\\_ISCED\\_2011\\_.28levels\\_of\\_education.29](https://ec.europa.eu/eurostat/statistics-explained/index.php?title=International_Standard_Classification_of_Education_(ISCED)#Implementation_of_ISCED_2011_.28levels_of_education.29)).

Sociodemographic variables (age, sex, faculty, and degree (year), having a bachelor's degree or associate degree in health sciences for academic and administrative staff, perceived socioeconomic status, use of prescribed medication/unprescribed medication/vitamin, and perceived general health assessment) were collected.

The Turkish version of the Single Item Literacy Screener (SILS) developed by Morris et al.<sup>18</sup> was used to evaluate the need of individuals in reading and comprehension of health-related materials. The item was as follows; "How often do you need someone to help you when you read instructions, pamphlets, or other written material from your doctor or pharmacy?". A 5-Likert scale (ranging from never to always) was used in this self-report instrument, and the cut-off was greater than 2 to identify subjects with limited reading ability of health-related information.

The two-week test-retest reliability for second and final versions of MELSA-TR was evaluated on 30 participants (a separate sample of individuals who were recruited neither in the test-retest nor the psychometric study). The discrimination index (which was considered as excellent if it was greater than 0.4) and the difficulty index (which is considered as difficult if it was less than 30%) were calculated.<sup>19</sup>

Kuder Richardson 20 coefficient was calculated to determine the internal consistency of the scale. A shorter and more reliable version of the scale with 8 items was created taking into consideration the discrimination index, the difficulty index, and Kuder Richardson 20 coefficient. Principal component analysis was conducted.

The following hypothesis was tested to evaluate the construct validity of the scale: *Students (fourth and fifth-grade students of faculty of pharmacy) and graduates (academic and administrative staff with bachelor's degree or associate degree in health science) of health science have higher scores on the medication literacy scale when compared to participants who did not have any education on health sciences.* The study was conducted among all university students regardless of their grades. However, the hypothesis was restricted to only the fourth and fifth-grade students of the faculty of pharmacy because the pharmacy students have been receiving professional pharmacy courses in these grades according to the national pharmacy core education program in Turkey

([https://www.yok.gov.tr/Documents/Kurumsal/egitim\\_ogretim\\_dairesi/Ulusal-cekirdek-egitimi-programlari/eczacilik\\_cep.pdf](https://www.yok.gov.tr/Documents/Kurumsal/egitim_ogretim_dairesi/Ulusal-cekirdek-egitimi-programlari/eczacilik_cep.pdf)).

### **Statistical Analysis**

Descriptive data were presented as medians [25<sup>th</sup>-75<sup>th</sup> percentiles] and numbers (percentages), where appropriate. Kolmogorov-Smirnov test was used to assess the normality of the data. Since the data did not follow a normal distribution, continuous variables for two and more than two groups were compared with Mann Whitney U and Kruskal Wallis tests, respectively. Kuder Richardson 20 coefficient was calculated to determine internal consistency. Principal component analysis was conducted. Spearman's correlation and Wilcoxon test were used to evaluate test-retest reliability.  $p < 0.05$  was set as the level of statistical significance. Data analysis was performed by IBM® SPSS® 11 software.

### **Results**

The online survey link was accessed by 752 participants. Fourteen participants declined to participate. Three hundred eighty participants did not complete the survey. So, 358 of the 752 (47.6%) were included in the analysis. The median [25<sup>th</sup>-75<sup>th</sup> percentiles] age was 22 [21-24] years (minimum-maximum: 19-62). The characteristics of the participants (n=358) are presented in Table 1.

For the final version of MELSA-TR, the test-retest reliability (n=30) showed a positive correlation between the scores of the scale at baseline and after a two-week interval (Spearman's rho=0.570;  $p<0.01$ ). There was no significant difference between the test and retest scores ( $p=0.308$ ) (data not shown).

Kuder Richardson 20 coefficient was 0.762 for the second version of MELSA-TR. The final version was limited to 8 items taking into consideration the content of the items, discrimination index, the difficulty index, and Kuder Richardson 20 coefficient. Kuder Richardson 20 coefficient was 0.659 for the final version consisting of 8 items. The median [25<sup>th</sup>-75<sup>th</sup> percentiles] score of the scale was 8.0 [7.0-8.0]. Kaiser-Meyer-Olkin Measure of Sampling Adequacy was 0.776 with Bartlett's Test of Sphericity was significant ( $p<0.001$ ). Only one factor was extracted by principal component analysis. The content of the items, the proportion of correct responses, corrected item-total correlation, and Kuder Richardson 20 coefficient if item deleted for each item are presented in Table 2.

Students (fourth and fifth-grade students of faculty of pharmacy) and graduates (academic and administrative staff with bachelor's degrees or associate degrees in health science) of health science had significantly higher scores on the medication literacy scale when compared to the participants who did not have any education on health sciences (the median [25<sup>th</sup>-75<sup>th</sup> percentiles]: 8.0 [8.0-8.0] vs. 7.0 [6.0-8.0], respectively;  $p<0.001$ ). Female participants had significantly higher scores on medication literacy scale compared to the males (the median [25<sup>th</sup>-75<sup>th</sup> percentiles]: 8.0 [7.0-8.0] vs. 7.0 [6.0-8.0], respectively;  $p=0.001$ ). Participants with the high reading ability of health-related information had significantly higher scores on the medication literacy scale when compared to the ones having the limited reading ability (the median [25<sup>th</sup>-75<sup>th</sup> percentiles]: 8.0 [7.0-8.0] vs. 7.0 [6.0-8.0], respectively;  $p=0.002$ ). Medication literacy scale scores by participants' characteristics are presented in Table 3.

## Discussion

Content validity, the test-retest validity, internal consistency, and Construct validity of MELSA-TR were confirmed in this study. Like the previously developed medication literacy scales<sup>2,8,10</sup>, Kuder Richardson 20 coefficient of MELSA-TR was determined as 0.659 and acceptable. So, we suggest that MELSA-TR is valid tool for adults having at least 12 years of education. However, we used a sample with a significant representation from healthcare professionals so the generalizability of our findings for adults with medium to high level of education should be evaluated with caution. It would be useful to conduct further studies evaluating the psychometric properties of this scale in participants with diverse characteristics.

Like similar medication literacy scales<sup>2,8-10</sup>, our scale consisted of numeracy questions (including calculation of dose and refill prescription date) items related to prose and document literacy. Pantuzza et al.<sup>5</sup> defined four constructs of medication literacy: functional literacy, communicative literacy, critical literacy, and numeracy. The items in MELSA-TR had items to assess all these constructs. During the COVID-19 pandemic an infodemic had arisen<sup>20</sup>, so we included two items related to critical and communicative literacy about the news on social media/television and purchasing herbal medicine on the internet, the advice taken from relatives/friends, and communication with physicians/pharmacists.

### *Limitations of the study*

We used an online survey to determine the psychometric properties of the scale due to the COVID-19 pandemic which might have resulted with a selection bias. The participants who used internet more frequently and/or were more interested in medication information might have participated more, resulting with an overestimation of total scores. Also in an online survey, the participants might have gotten some guidance in filling out the questionnaire. The participants were adults with medium to high level of education who had worked and/or studied at universities, and some of them were health science students and/or professionals, which also limit the generalizability of the findings.

### **Conclusion**

MELSA-TR could be used to evaluate the medication literacy levels of adults having at least 12 years of education in Turkey. There is still a need to test the psychometric properties of the scale on diverse populations, particularly on socioeconomic disadvantaged groups, before using it extensively. This scale has many advantages such as being a self-reported, valid, easily applicable, and not time-consuming tool. It also does not consist of items related to the country-based healthcare system. Still, we note that further studies among participants with diverse characteristics (particularly on socioeconomic disadvantaged groups) would be useful for evaluating psychometric properties in more detail.

### **Funding**

The project entitled ‘A Scale Development Project to Determine Individuals’ Medication Literacy, and Attitudes Regarding Rational Medication Use’ was supported by TUBITAK 2209-A program (No: 1919B012001763).

### **Conflict of interest disclosure statements**

The authors declare no conflict of interest.

### **Data availability**

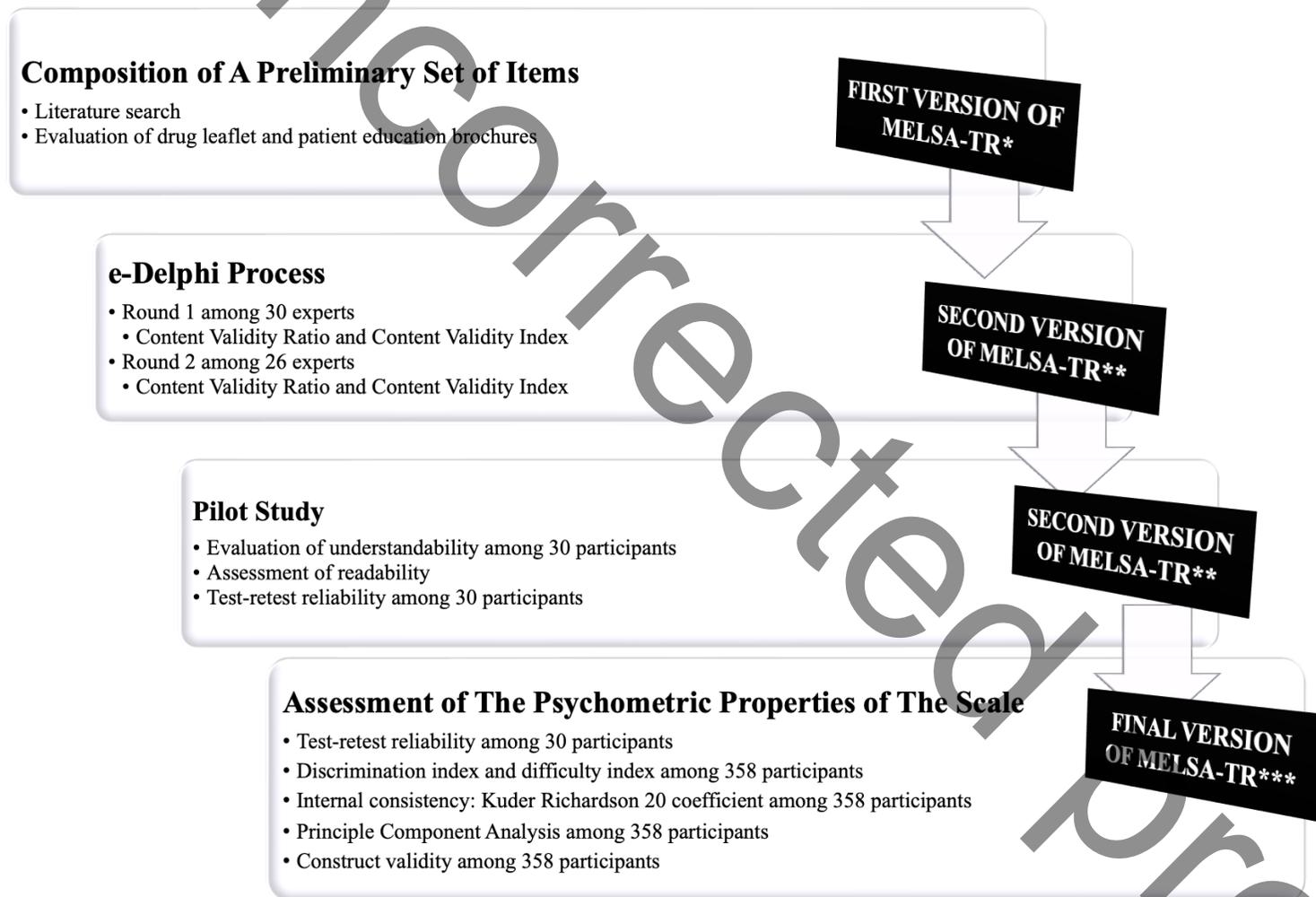
Data are available from the corresponding author on reasonable request.

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**Figure 1.** Flowchart representing the development and evaluation of MELSA-TR process \*It consisted of 27 items. \*\*It consisted of 23 items \*\*\*It consisted of 8 items.

**Table 1.** Characteristics of the participants (n=358)

	n (%)
<b>Sex</b>	
Female	272 (76.0)
Male	86 (24.0)
<b>Students* or graduates** of health sciences</b>	
Yes	134 (37.4)
No	224 (62.6)
<b>Perceived socioeconomic status</b>	
Low	3 (0.8)
Low-Moderate	82 (22.9)
Moderate	186 (52.0)
High-Moderate	75 (20.9)
High	12 (3.4)
<b>Use of prescribed medication / unprescribed medication/vitamins</b>	
Yes	105 (29.3)
No	253 (70.7)
<b>Perceived general health</b>	
Perfect	16 (4.5)
Pretty good	135 (37.7)
Good	161 (45.0)
Not bad	43 (12.0)
Bad	3 (0.8)
<b>SILS</b>	
High reading ability of health-related information	289 (80.7)
Limited reading ability of health-related information	69 (19.3)

SILS: Single Item Literacy Screener; \*fourth and fifth-grade students of faculty of pharmacy; \*\*academic and administrative staff with bachelor's degree or associate degree in health science

**Table 2.** Content of the items and proportion of correct responses, corrected Item-Total Correlation and Kuder Richardson 20 Coefficient if item deleted for each item of MELSA-TR (n=358)

Items	Classification	Content of the item	Proportion of correct responses n (%)	Corrected Item-Total Correlation	Kuder Richardson 20 Coefficient if Item Deleted
Item-1	e-Medication Literacy	<i>After the news on social media/television about its harmful effects, deciding to continue taking a regularly used medicine, if the physicians'/pharmacists tell it is safe.</i>	319 (89.1)	0.306	0.639
Item-2	Dose	<i>Selecting appropriate paediatric dose of paracetamol suspension according to child's age and weight (a dose table presented to the participants)</i>	292 (81.6)	0.343	0.633
Item-3	Indication	<i>Selecting the right medicine for heartburn according to indication information on the medicine box (the virtual medicine boxes presented to the participants)</i>	266 (74.3)	0.376	0.628
Item-4	Calculating total daily dose	<i>Calculating the total daily paracetamol dose in two products containing paracetamol (daily dose regimen and the virtual medicine boxes presented to the participants)</i>	315 (88.0)	0.470	0.596
Item-5	Calculating time for dose	<i>Calculating administration timing of an antibiotic dose</i>	328 (91.6)	0.368	0.625
Item-6	Dose administration	<i>Deciding whether a re-shake is needed or not before each dose of antibiotic suspension if it has been diluted, prepared and shake in the initial use. The antibiotic suspension had a warning as "Shake before each dose",</i>	354 (98.9)	0.336	0.651
Item-7	Potential drug-drug interaction	<i>Selecting appropriate administration timing of two medications (levothyroxine and iron product) that should be taken at different times because of a potential drug-drug interaction (the virtual instruction presented to the participants)</i>	327 (91.3)	0.451	0.606
Item-8	Storage	<i>Deciding about the storage conditions of an oral suspension bottle (the virtual instruction presented to the participants)</i>	313 (87.4)	0.300	0.641

**Table 3.** MELSA-TR Scores by participants' characteristics (n=358)

	<b>MELSA-TR Score</b>	<b><i>p</i> value</b>
	<b>Median</b>	
	<b>[25<sup>th</sup>-75<sup>th</sup></b>	
	<b>percentiles]</b>	
<b>Sex</b>		
Female	8.0 [7.0-8.0]	0.001
Male	7.0 [6.0-8.0]	
<b>Students* or graduates** of health sciences</b>		
Yes	8.0 [8.0-8.0]	<0.001
No	7.0 [6.0-8.0]	
<b>Perceived socioeconomic status</b>		
Low and Low-Moderate	8.0 [6.5-8.0]	0.844
Moderate	8.0 [6.75-8.0]	
High and High-Moderate	7.0 [7.0-8.0]	
<b>Use of prescribed medication /unprescribed medication/vitamin</b>		
Yes	8.0 [7.0-8.0]	0.127
No	7.0 [6.0-8.0]	
<b>Perceived general health</b>		
Perfect and Pretty good	8.0 [7.0-8.0]	0.188
Good	8.0 [7.0-8.0]	
Bad and not bad	7.0 [6.0-8.0]	
<b>SILS</b>		
High reading ability of health-related information	8.0 [7.0-8.0]	0.002
Limited reading ability of health-related information	7.0 [6.0-8.0]	

SILS: Single Item Literacy Screener; \*fourth and fifth-grade students of faculty of pharmacy; \*\*academic and administrative staff with bachelor's degree or associate degree in health science