

# Validity and Reliability of the Amharic Version of the HLS-EU-Q47 Survey Questionnaire among Urban School Adolescents and University students in Dire Dawa, Ethiopia

Hailemariam Mamo Hassen (✉ [1781133@kiit.ac.in](mailto:1781133@kiit.ac.in))

Dire Dawa University <https://orcid.org/0000-0002-9584-2408>

Manas Ranjan Behera

KIIT University

Pratap Kumar Jena

KIIT University

Sudhir K Kumar Satpathy

KIIT University

---

## Research

**Keywords:** Amharic, Health Literacy, HLS-EU-Q47, HLS-Amh, Validity, Reliability

**Posted Date:** March 13th, 2020

**DOI:** <https://doi.org/10.21203/rs.3.rs-17073/v1>

**License:**   This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

---

# Abstract

**Background:** Comprehensive tool is not available to assess health literacy status across different languages, contexts and population structures except European health literacy survey scale (HLS-EU-Q47) which is widely used adapted and tested in different countries and languages. However, it was not tested for Ethiopian populations. This study aim was to validate and test the reliability of the Amharic version of the HLS-EU-Q47 survey questionnaire (HLS-Amh) among school adolescents and university students in Dire Dawa, Ethiopia.

**Method:** A cross-sectional study with multistage random sampling was done on urban school adolescents and university students from public schools and Dire Dawa University in Dire Dawa city, Ethiopia, Africa. After translating HLS-EU-Q47 into Amharic by translation and back-translation, data was collected using a self-reported questionnaire from samples of 744 participants with 9% non-response rate in October and November, 2018. Confirmatory factor analysis and correlation analysis was done using SPSS and AMOS. Goodness of fit indices, item-scale convergent validity, Pearson correlation coefficient, floor and ceiling effects, Cronbach's alpha and split-half spearman-brown coefficient was computed taking the cut-off values from guidelines and literatures. Ethical issue was contemplated and informed consent was obtained from institutions and participants.

**Result:** Amharic version of HLS- EU-Q47, (HLS-Amh) was reliable but weak for its validity to measure health literacy among urban school adolescents and university students in Dire Dawa, Ethiopia. Goodness-of-fit indices (GFI, AGFI, CFI and IFI) were within range of 0.90-0.80. Although, RMSEA indices were less 0.10, others have made it insufficient to be said as a good model-data fit and was not tolerable for its validity, and the model lacked strength to meet the model-fit indices satisfaction with higher apparent floor/ceiling effects. However, it showed high levels of internal consistency of reliability with relatively higher Cronbach's alpha coefficient ( $\alpha=0.910$ ).

**Conclusions:** HLS-Amh was reliable but weak for its validity on these population groups. It can be used for a general survey on awareness and knowledge other than screening substantial and clinical related inquiries. It needs further adaptation and validation for comprehensiveness for demographic, multi-lingual and cultural contexts in Ethiopia.

## Background

Health literacy has become a significant concept and one of the major global health priorities to predict factors and mechanisms of health disparities[1]. Essentially, it is a cognitive and social skill, described as the extent to which people know, are motivated and able to acquire, process, comprehend and use health information in health-related decisions[2, 3]. It was implicitly evolved from Gandhi's campaign and efforts in India and as well as volunteers in Africa in the promotion of literacy and health[3, 4]. Later on, the word and its concept originated in the United States of America in 1974 by Scott K. Simonds in his work on health education as a policy issue in schools for all grades[5]. These days, it is growing and emerging

faster and becoming one of the new healthcare and public health priorities[6]. Its conceptual, theoretical, and practical advances and intervention programs have been expanding[7].

Health literacy measurement tools were introduced in United States of America adapting literacy tests to healthcare settings which was focused on the ability to read and understand health care messages and medical instructions provided in texts and written documents comprising labels in form of numbers on prescriptions, medicines and slips for appointment[8]. These were mainly rapid estimate of adult literacy in medicine (REALM)[9], test of functional health literacy in adults (TOFHLA)[10], wide range achievement test (WRAT), health activities literacy scale (HALS)[11], newest vital sign (NVS)[12] and health activities literacy scale (HALS)[11]. These measurement tools and other similar instruments were developed based on functional literacy (reading and writing ability) and expressed qualitatively.

Health literacy is a multidimensional and multifaceted construct concept [13] so that there exists variation in indicators and measurement tools[14],[15]. Taking these in account, the European Health Literacy (HLS-EU) project that took place 2009–2012 supported and funded by the European Commission and the national partners in the HSL-EU Consortium aiming to measure health literacy in Europe, establish networks and to promote health literacy in Europe[16–18]. As starting point for measuring health literacy in Europe, the HLS-EU consortium has assumed “all-inclusive” health literacy definition from literatures framing a conceptual model[16] that described as individuals knowledge, motivation and ability to access, process, understand, appraise, and apply health information for making judgments and decisions in daily life about maintaining and improving quality of life through healthcare, disease prevention and health promotion[2, 16, 17, 19, 20]. The core version (HLS-EU-Q47) measuring health literacy consisting 47 items is widely used and allied to the definition and conceptual model has been adapted and tested for its reliability and validity in different countries, in different language and cultural settings in general population and specific age groups and almost has found valid and reliable with some detected limitations[2, 3, 29, 21–28].

However, in these days, there has not been a universally agreed definition of health literacy resulting conceptual and construct discrepancy across languages is fraught with difficulty during translations[3]. Furthermore, comprehensive instruments to measure health literacy across different contexts and settings are uncommon[28]. Such similar studies did not also include African countries including the Ethiopian population in general and among school adolescents and university students in particular. Therefore, the purpose of the study was to validate and test the reliability of the factor structure of the Amharic version of the HLS-EU-Q47 survey questionnaire (HLS-Amh) underlying from the data among urban school adolescents and university students in Dire Dawa, Ethiopia.

## **Methods And Materials**

### **Study design and setting**

A cross-sectional study was designed and conducted among urban school adolescents from junior and secondary grade levels and university students pursuing first-year courses. These sample participants were taken randomly from public schools and Dire Dawa University in Dire Dawa city, Ethiopia, Africa. The study area is located at the Eastern part of Ethiopia which is one of the two self-administering city provinces in Ethiopia, approximately 515 km far from the capital, Addis Ababa.

An estimated adequate sample size of 744 study participants were selected randomly of which about 677 of them completed the questionnaire properly with 9% non-response rate. Participant school adolescents were about 363(53.32%) of which 172(25.11%) were from eight junior schools (grade 6–8) and others 191(28.21%) were from six secondary schools randomly selected among schools in the province. The remaining were university first-year students 314(46.68%) who were selected randomly from Dire Dawa University across different departments. The mean age of both gender categories was  $18.60 \pm 3.175$  (10–25 years) among which about 309(45.64%) were females and the remaining 368(54.36%) were males.

The HLS-EU-Q47 was tested for its validity and reliability in the Amharic version (HLS-Amh) that Amharic is the official federal working language of Ethiopia and in some other five states including Dire Dawa city.

HLS-EU-Q47 that was developed and validated by European health literacy consortium in European contexts containing 47 items rated on 4-point Likert scales (1 = very difficult, 2 = difficult, 3 = easy, and 4 = very easy)[18, 20] was taken. It was translated into Amharic language using the translation and back-translation method by language and subject area professionals taking into account the cultural and societal contexts. The questionnaire was then pre-tested. Data was collected using a self-reported questionnaire from the end of the week of October through the second week of November, 2018 by the principal author and with help of two other oriented-assistants from Dire Dawa University academic faculties in collaboration with school principals and academic program heads.

## **Statistical Analysis**

Data were screened and examined for missing and inappropriate responses with list wise deletion dropping these cases from the analysis including deletion of outliers and checking for univariate and multivariate normality and maximum likelihood (ML) with assumption of multivariate normality (MVN). Cut off values were taken from guidelines about reporting results of structural equation modelling specifically, confirmatory factor analysis[30–35] and it was done along with correlation analysis and descriptive analysis using SPSS version 23 and Analysis of Moment Structures (AMOS version 23) which is an added into SPSS module specially used for structural equation model, path analysis, and confirmatory factor analysis.

Statistical analysis was conducted focusing on testing the validity and reliability. Validity analysis was established conducting confirmatory factor analysis (CFA) for the general and three separate health literacy domains of health care, disease prevention, and health promotion. Items were loaded onto hypothetical factors (finding, understanding, judging, and applying health information). Goodness-of-fit

indices were used to test fit of the data to the model most importantly (i) absolute model fit: root mean square error of approximation (RMSEA) and goodness-of-fit index (GFI);(ii) incremental fit: adjusted goodness-of-fit index (AGFI), comparative fit index (CFI), incremental fit index (IFI), and normal fit index (NFI); and (iii) parsimonious fit, or the chi-square goodness-of-fit test (i.e., the chi-square/degrees of freedom ratio [ $\chi^2/df$  ratio]) with the assumptions that more satisfied indices indicate better construct validity of the questionnaire[30, 34]. Item-scale convergent validity was examined using correlation between the item and its theoretical scale[18] which was determined by the Pearson correlation coefficient. When the r-value was between 0.36 and 0.67, it was considered moderately correlated; r values between 0.68 and 1.0 were considered highly correlated [30, 34, 36].

Reliability analyse was done to test internal consistency with Cronbach's alpha, and values greater than or equal to 0.7 was assumed as indicator for satisfactory reliability[37]. The split-half reliability was also examined[38]. Due to the limited responsiveness of such a large-scale survey, floor or ceiling effects, which refer to a high percentage of participants scoring possibly the lowest score or achieving possibly the highest score, respectively, were concerned[36]. Therefore, minimal cut-offs for significant floor and ceiling effects were recommended, and for the HLS-EU-Q47 scale, a percentage of 15% or more at floor or ceiling was considered a significant effect[36]. Statistical analyses were done analysis using SPSS version 23 and Analysis of a Moment Structures (AMOS version 23). The significance level was set at  $P < 0.05$  at 95% confidence interval.

## Result

### Characteristics of Participants

The mean age was  $18.60 \pm 3.175$  (10–25 years). Of the participant school adolescents and university students, about 309(45.64) were females and 368(54.36) were males. They were sampled from junior primary grade levels (172(25.11%)), secondary grade levels (191(28.21%)) and university students pursuing 1st degree (314(46.68%)). The mean age, age groups, and grade level along with the respective gender category were shown (Table 1).

### Measurements Of Construct Validity

The confirmatory factor analysis (CFA) was employed to test construct validity. Under this section, goodness-of-fit indices (RMSEA, GFI, AGFI, CFI, NFI, and IFI) were shown for the data in the hypothetical model fit for the general and/or the three domains of health literacy in overall participants and for both school adolescents and university students (Table 4). The RMSEA index was less 0.10, and other goodness-of-fit indices (GFI, AGFI, CFI and IFI) were within range from 0.90 to 0.80 for most domains for overall participants and for both school adolescents and university students. The NFI score for all domains in both groups were lower than 0.80. In particular, the AGFI was approximately 0.90 for general health literacy (Gen-HL), disease prevention health literacy (DP-HL), health care health literacy (HC-HL)

and health promotion health literacy (HP-HL) in both categories, while the NFI index was below 0.80 for these indexes, except for DP-HC and HP-HL in overall participants. As shown in Fig. 1, the item-total correlations ranged from 0.287 to 0.542.

## Item-scale Convergent Calidity

Most of these items were shown not to have satisfactory item-scale evidently each of the items had shown to have very weak correlation( $\rho$ ) each other from  $-0.022$  to  $0.450$  with variations of laying with these range from general health literacy to each of the three sub-domains for both categories of participants (Table 4)

## Floor And Ceiling Effects

There was significant floor or ceiling effects, as the percentages of people with the lowest scores or the highest mean and individual item scores of health literacy were greater than 15%. The percentage of scores on the floor ranged from 12.40–31.40% with a mean floor score of 20.30% in general health literacy of both participants altogether. In addition, the percentage of scores at the ceiling ranged from 10.80–33.53% with average ceiling score of 20.88. Similarly, it had shown higher and significant floor and ceiling affects urban school adolescents and university students separately for the general and for the three sub-domains of health literacy (Table 4).

## Measurements Of Reliability

The reliability of the Amharic version HLS-EU-Q47 for these urban adolescents and university students was relatively higher Cronbach's alpha coefficient ( $\alpha = 0.910$ ). The internal consistency (Cronbach's alpha) for the 47 items in University students' participants was higher than 0.90 and it was 0.88 for school adolescents. Most of the sub-scales had high internal consistency with scores with a range of 0.787–0.935, except DP-HL in school adolescents was 0.743. Likewise, the split-half Spearman-Brown coefficients ranged from 0.621 for diseases prevention-related health literacy among school adolescents to 0.88 for general literacy among participant university students and were mostly respectably satisfactory for Gen-HL and three domains (HC-HL, DP-HL, and HP- HL) (Table 4).

## Discussion

The present study was the first to the authors' knowledge investigating the psychometric properties of HLS-EU-Q47 among Ethiopian population groups. The HLS-EU-Q47 does not measure functional health literacy[20]. It does not evolve any objective items because it is a subjective measurement mainly individuals oriented exclusively in mode a pencil and paper testing[23]. Thus, the study took these facets into account and only focus on the constructs of HLS-EU-Q47.

It has shown that the Amharic version of HLS-EU-Q47 (HLS-Amh) was not a valid but reliable tool to measure health literacy among the urban school adolescents and university students in Dire Dawa Ethiopia. The result lacked strength to meet the model-fit indices satisfaction for its validity[30, 32–34, 39] and had not adequate item-scale convergent validity, with higher apparent floor/ceiling effects although it had high levels of internal consistency reliability.

Regarding construct validity of the instrument, it did not show a good fit of the data to the hypothetical model for the general and/or for the three domains of health literacy in overall participants and/or for both school adolescents and university students. Although, the RMSEA index was less 0.10, the other goodness-of-fit indices (GFI, AGFI, CFI and IFI) were less than 0.90 but greater than 0.80 for most domains for overall participants and for both school adolescents and university students. The NFI score for all domains in both groups were lower than 0.80 which is insufficient to be said as a good model-data fit[34, 38]. In particular, the AGFI was approximately 0.90 for general health literacy (Gen-HL), disease prevention health literacy (DP-HL), health care health literacy (HC-HL) and health promotion health literacy (HP-HL) in both categories; while the NFI index was below 0.80 for these indexes, except for DP-HC and HP-HL in overall participants representing a fit that was not tolerable for its validity[30, 32–34, 39].

The overall results did not support the fitness of the four-factor structure within each of the three domains of the HLS-EU-Q47 of the Amharic version (HLS-Amh) within Ethiopian sampled urban school adolescents and university students (Table 4). As shown from Table 3 and Fig. 1, the factor loading (items-factor correlations) ranged from 0.287 to 0.542 showed estimated population factor structure, and indicated that each item of the measurement instrument contribution to measure the factor (health literacy) was lower. Several literature and guidelines showed a dataset factor loading scores should be > 0.80) so that each item could contribute to the factor and indicate the dimensions of the factors sufficiently accounted for by that item[40, 41]. For example, a factor loading value of 0.30 translates to approximately 10% explanation and a factor loading value of 0.50 explains about 25% of the variance accounted for by the factor so that the factor loading score must be greater than 0.70 for the factor to account for 50% of the variance of a variable[42].

The evaluation of the factorial structure of data from Ethiopians urban school adolescents and university students in Dire Dawa structured as HLS-Amh can be used with both total and sub-dimensions scores for its reliability. However, the item loadings of these constructs were below 0.5 which showed its weakness and instability. As a rule of thumb, if the item loadings in one factor are below 0.50 factors are considered as unstable[42]. As these items loadings in the scale factors were inadequate, it is concluded that the construct validity of the HLS-Amh was not supported. Further anticipated evidence for construct validity was the statistical significance and high correlations between HLS-Amh and sub-dimension scores. It is anticipated that individuals with better health care literacy could be literate in general health literacy, disease prevention, and health promotion. In this study, Pearson correlation coefficients between Gen-HL and three sub-dimensions scores showed these coefficients with Gen-HL were found as 0.780, 0.836 and 0.807 with the sub-dimensions HC, DP and HP, respectively and higher correlation coefficient between

these sub-dimensions (Table 2). These values were closer to several studies results in European and Asian countries and a study in Brazil showed similar results[15, 19, 25–29]. Regarding item-scale convergent validity, most of these items evidently had shown to have very weak correlation ( $\rho$ ) ranging from  $-0.022$  to  $0.450$  with variations within these range for general health literacy and for each of these three subscales in both categories of participants (Table 3).

The presence of floor and/or ceiling effects are counted when more than 15% of respondents have had the lowest or highest possible score, respectively[36]. Accordingly, there was significant floor or ceiling effects, as the percentages of participants who had the lowest and the highest health literacy mean and individual item scores far higher than 15%, confirming the presence of higher floor/ceiling effects. The percentage of scores on the floor ranged from 12.40–31.40% with a mean floor score of 20.30% in general health literacy of both participants altogether. In addition, the percentage of scores at the ceiling ranged from 10.80–33.53% with average ceiling score of 20.88. Similarly, it had shown greater and significant floor and ceiling effects for urban school adolescents and university students separately for the general and for the three sub-domains of health literacy (Table 3). The presence of floor and/or ceiling effects imply extreme scores were achieved for items in the lower or upper end of the scale indicating limited content validity that further impact the reliability[28, 36]. These results indicated that the responsiveness of HLS-EU-Q47 scale in Amharic version (HLS-Amh) was unsatisfactory and was not able to differentiate individuals with low or high health literacy in surveying the urban school adolescents and university students' health literacy in Dire Dawa, Ethiopia.

The reliability of the Amharic version HLS-EU-Q47 (HL-Amh) to measure health literacy of urban adolescents and university students in Dire Dawa, Ethiopia was relatively higher (Cronbach's alpha coefficient = 0.910). The internal consistency (Cronbach's alpha) for the 47 items in University students participants was greater than 0.90 and it was 0.88 for school adolescents. Most of the sub-scales had high internal consistency with scores range of 0.787–0.935, except DP-HL in school adolescents that was 0.743 still at the acceptable levels (Cronbach's alpha  $> 0.70$ ) [37]. In addition, the split-half Spearman-Brown coefficients ranged from 0.621 for diseases prevention-related health literacy among school adolescents to 0.88 which was for general literacy among participant university students. These were mostly respectably satisfactory[36–38] for Gen-HL and three domains (HC-HL, DP-HL, and HP- HL) HL (Table 3). Thus, the instrument was reliable, with high internal consistencies of HC-HL, DP-HL, and HP-HL similar to those identified in the original HLS-EU survey despite its weakness for construct and convergent validity. A reliability coefficient of 0.80 is considered as the lowest acceptable threshold for a well-developed measurement tool[37]. Accordingly, the internal consistency of HLS-Amh indicated with the Cronbach's alpha coefficients was satisfactorily high for both GEN-HL (0.910) and all three subscales (Table 4).

In the original European study, internal consistency reliability (Cronbach's alpha coefficients) were all greater than 0.90[18]. Similarly, the coefficients that were obtained in several European countries (Austria, Bulgaria, Germany, Greece, Spain, Ireland, the Netherlands, and Poland) were about 0.90 or higher[2, 20]. The various adaptation studies of the HLS-EU scale in other countries obtained were quite similar values.

For the Japanese version of the scale, Cronbach's alpha was 0.97 for GEN-HL and 0.91, 0.91 and 0.92, respectively, for the three sub-dimensions[24]. In a syndicated study in Turkey in which the HLS-EU-Q47 scale was used, Cronbach's alpha was found to be 0.97 and for the sub-dimensions HC, DP and HP, they were found to be 0.91, 0.92 and 0.93, respectively[29]. However, the alpha coefficients in our study revealed relatively lower for the three subscales and among the participants from urban school adolescents that HLS-Amh was a relatively less reliable measuring instrument in the study context and population settings. The Amharic version HLS-EU-Q47 is therefore shown to be reliable but, was weaker for its validity so that there is and need to develop another comprehensive health literacy measurement for urban school adolescents and university students as well as Ethiopian population.

## Conclusions

The Amharic version of HLS-EU-Q47 for urban school adolescents and university students in Dire Dawa, Ethiopia was reliable but weak for its validity. To this end, this tool can be used as a broader and general survey tool on awareness and knowledge other than being a tool for screening substantial and clinical related inquiries. Using the tool and the sampling method would provide comparable importance to identify associated factors with health literacy.

The study result has shown the need for further adaptation and validation for comprehensive tool in Ethiopian demographic, multi-lingual and cultural contexts. Researchers who want to survey health literacy using HLS-EU-Q47 in Ethiopian population should reconsider the validity of this tool for its relevance to cultural competence and multilingual state of study participants in which local dialects, plain language and combined aspects of two or more languages. Moreover, the language competency of a given population should be considered in cases like Dire Dawa where multiple languages are spoken affecting and mix up of terminologies from varies languages might cause confusion in understanding statements of a given language. More involvement of local specific literature and language experts in addition to specific content and subject area professionals is essential.

## Declarations

### List of abbreviations

AGFI	Adjusted Goodness of Fit Index
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
DP-HL	Disease Prevention Health Literacy
GEN-HL	General Health Literacy
GFI	Goodness-Of-Fit Index

HALS	Health Activities Literacy Scale
HC-HL	Health Care Health Literacy
HLS-Amh	Amharic version of health literacy survey scale
HLS-EU-Q47	European Health Literacy Survey Scale Questionnaire
HP-HL	Health Promotion Health Literacy
IFI	Incremental Fit Index
ML	Maximum Likelihood
MVN	Multivariate Normality
NFI	Normal Fit Index
NVS	Newest Vital Sign
REALM	Rapid Estimate of Adult Literacy in Medicine
RMSEA	Root Mean Square Error of Approximation
SPSS	Statistical <i>Package for the Social Sciences</i>
TOFHLA	Test of Functional Health Literacy in Adults
WRAT	Wide Range Achievement Test

### **Ethics approval and consent to participate**

Ethical review was granted from KIIT University, Institute of Medical Sciences Institutional Ethics Committee (Ref. No. KIIT/KIMS/IEC/63/2019). Informed, voluntary, written and signed consent was obtained from each of the participant and their respective parents/guardians for adolescents below age of 18 years old; for youth students who are 18 years and above was obtained from themselves. Consent was obtained from heads of each sampled institutions. Respect for anonymity and confidentiality of the participants' information will be maintained.

### **Consent for publication**

Not applicable

### **Availability of data and material**

The datasets analysed for the study are available supplementary file or can be obtained from corresponding author on reasonable request.

## Competing interests

The authors declare that they have no competing of interest has been declared by the authors

## Funding

This research received no specific grant. However, Dire Dawa University had supported and facilitated in-kind and administrative aspects.

## Authors' contributions

HMM designed the study, analysed, interpreted data and wrote the manuscript. MRB, PKJ and SKS provided advisory, guidance and involved in framing the study protocol and procedures.

## Acknowledgements

The authors would like to acknowledge Dire Dawa University, Dire Dawa Education Bureau, School directors in Dire Dawa and Melaku Adinew for their valuable assistance and facilitation during data collection.

## Authors' information

\*HMM is a PhD Candidate, KIIT University, School of Public Health and Lecturer, Dire Dawa. University, Ethiopia

MRB and PKJ are Associate Professors in KIIT University School of Public Health

SKS is Professors and Director in KIIT School of Public Health, KIIT University

## References

- [1] Paakkari LT, Torppa MP, Paakkari O-P, Välimaa RS, Ojala KSA, Tynjälä JA. Does health literacy explain the link between structural stratifiers and adolescent health? *Eur J Public Health* 2019;1–6. doi:10.1093/eurpub/ckz011.
- [2] Sørensen K, Van Den Broucke S, Fullam J, Doyle G, Pelikan J, Slonska Z, et al. Health literacy and public health: A systematic review and integration of definitions and models. *BMC Public Health* 2012;12. doi:10.1186/1471-2458-12-80.
- [3] IOM. *Health Literacy: Improving Health, Health Systems, and Health Policy Around the World: Workshop Summary*. Washington, DC: The National Academies Press.; 2013.
- [4] Callister, Lynn Clark, RN F. Global Health Literacy. *Fam Med* 2014;39:588–94. doi:10.1186/1471-2458-12-80.

- [5] Simonds S. Health education as social policy. *Heal Educ Monogr* 1974;2:1–25.
- [6] MCCRAY AT. Promoting Health Literacy. *J Am Med Informatics Assoc* 2005;12:2:152–63. doi:10.1197/jamia.M1687.
- [7] Ratzan SC. Health literacy: Communication for the public good. *Health Promot Int* 2001;16:207–14. doi:10.1093/heapro/16.2.207.
- [8] Williams M V. Inadequate functional health literacy among patients at two public hospitals. *J Am Med Assoc* 1995;274. doi:10.1001/jama.1995.03530210031026.
- [9] Nutbeam D. The evolving concept of health literacy. *Soc Sci Med* 2008;67:2072–8. doi:10.1016/j.socscimed.2008.09.050.
- [10] Parker RM, Baker DW, Williams M V., Nurss JR. The test of functional health literacy in adults: A New Instrument for Measuring Patients' Literacy Skills. *J Gen Intern Med* 1995;10:537–41. doi:10.1007/BF02640361.
- [11] Baker DW. The meaning and the measure of health literacy. *J Gen Intern Med* 2006;21:878–83. doi:10.1111/j.1525-1497.2006.00540.x.
- [12] Barry D. Weiss, Mary Z. Mays, , William Martz, Kelley Merriam Castro, Darren A. DeWalt, Michael P. Pignone, Joy Mockbee FAH. Quick Assessment of Literacy in Primary Care: The Newest Vital Sign. *Ann Fam Med* 2005;3:5–7. doi:10.1370/afm.405.College.
- [13] Dodson S, Good S OR. *Health Literacy Toolkit for low- and middle-income countries: a series of information sheets to empower communities and health systems*. New Delhi: World: 2015.
- [14] Haun JN, Valerio MA, McCormack LA, Sørensen K, Paasche-Orlow MK. Health literacy measurement: An inventory and descriptive summary of 51 instruments. *J Health Commun* 2014;19:302–33. doi:10.1080/10810730.2014.936571.
- [15] Guo S, Armstrong R, Waters E, Sathish T, Alif SM, Browne GR, et al. Quality of health literacy instruments used in children and adolescents: a systematic review 2018:1–18. doi:10.1136/bmjopen-2017-020080.
- [16] HLS-EU-Consortium. *HLS-EU 2012 Q-Tools and Introduction*. Exec Agency Heal Consum 2012:1–14.
- [17] Emiral G., Asygar H, Isiktekin B, Goktas S, Dagtekin G, Arslantas D, et al. Health Literacy scale-European union-Q-16: a validity and reliability study in Turkey. *Int Res J Med Sci Int Res J Med Sci* 2018;6:2320–7353.

- [18] Consortium TH, European T, Literacy H. Measurement of health literacy in Europe: HLS-EU-Q47; HLS-EU-Q16; and HLS-EU-Q86 The HLS-EU Consortium 2012 The European Health Literacy Project 2009-2012. HLS-EU Consort 2012.
- [19] Sørensen K, Van Den Broucke S, Pelikan JM, Fullam J, Doyle G, Slonska Z, et al. Measuring health literacy in populations: Illuminating the design and development process of the European Health Literacy Survey Questionnaire (HLS-EU-Q). *BMC Public Health* 2013;13. doi:10.1186/1471-2458-13-948.
- [20] Sørensen K, Pelikan JM, Röthlin F, Ganahl K, Slonska Z, Doyle G, et al. Health literacy in Europe: Comparative results of the European health literacy survey (HLS-EU). *Eur J Public Health* 2015;25:1053–8. doi:10.1093/eurpub/ckv043.
- [21] Chinn D, McCarthy C. All Aspects of Health Literacy Scale (AAHLS). *Patient Educ Couns* 2013;90:247–53. doi:10.1016/j.pec.2012.10.019 T4 - Developing a tool to measure functional, communicative and critical health literacy in primary healthcare settings M4 - Citavi.
- [22] Osborne RH, Batterham RW, Elsworth GR, Hawkins M, Buchbinder R. The grounded psychometric development and initial validation of the Health Literacy Questionnaire (HLQ). *BMC Public Health* 2013;13. doi:10.1186/1471-2458-13-658.
- [23] Haun JN, Valerio MA, McCormack LA, Sørensen K, Paasche-Orlow MK. Health literacy measurement: An inventory and descriptive summary of 51 instruments. *J Health Commun* 2014;19:302–33. doi:10.1080/10810730.2014.936571.
- [24] Nakayama K, Osaka W, Togari T, Ishikawa H, Yonekura Y, Sekido A, et al. Comprehensive health literacy in Japan is lower than in Europe: A validated Japanese-language assessment of health literacy. *BMC Public Health* 2015;15:1–12. doi:10.1186/s12889-015-1835-x.
- [25] Duong VT, Lin IF, Sorensen K, Pelikan JM, Van Den Broucke S, Lin YC, et al. Health literacy in Taiwan: A population-based study. *Asia-Pacific J Public Heal* 2015;27:871–80. doi:10.1177/1010539515607962.
- [26] Paakkari O, Torppa M, Kannas L, Paakkari L. Subjective health literacy: Development of a brief instrument for school-aged children. *Scand J Public Health* 2016;44:751–7. doi:10.1177/1403494816669639.
- [27] Carvalho GS, Cristina M, Araújo P, Boff ETO, Branca R. European Health Literacy Scale (HLS-EU-BR) Applied in A Brazilian Higher Education Population of Rio Grande Do Sul (RS). *Appl Of Information Technol* 2016;9:1289–95.
- [28] Duong T V., Aringazina A, Baisunova G, Nurjanah, Pham T V., Pham KM, et al. Measuring health literacy in Asia: Validation of the HLS-EU-Q47 survey tool in six Asian countries. *J Epidemiol* 2017;27:80–6. doi:10.1016/j.je.2016.09.005.

- [29] Emiral G.O., Aygar H., Isiktekin B., Göktas S., Dagtekin G. UA. Health literacy scale-European union-Q16: a validity and reliability study in Turkey. *Int Res J Med Sci* 2018;6:1–7.
- [30] Hu LT, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *J Educ Psychol* 1999;6:1–55. doi:10.1080/10705519909540118.
- [31] Sivo SA, Xitao FAN, Witta EL, Willse JT. The search for “optimal” cutoff properties: Fit index criteria in structural equation modeling. *J Exp Educ* 2006;74:267–88. doi:10.3200/JEXE.74.3.267-288.
- [32] Niemand T, Mai R. Flexible cutoff values for fit indices in the evaluation of structural equation models. *J Acad Mark Sci* 2018;46:1148–72. doi:10.1007/s11747-018-0602-9.
- [33] Lewis T. Fit Statistics commonly reported for CFA and SEM. *Cornell Stat Dep* 2017;08:0–1.
- [34] Streiner DL, Kottner J. Recommendations for reporting the results of studies of instrument and scale development and testing. *J Adv Nurs* 2014;70:1970–9. doi:10.1111/jan.12402.
- [35] Hooper D, Coughlan J, Mullen M. Structural equation modelling: Guidelines for determining model fit. *Electronic Journal of Business Research Methods. Electron J Bus Res Methods* 2008;6:53–9. doi:10.1037/1082-989X.12.1.58.
- [36] Terwee CB, Bot SDM, de Boer MR, van der Windt DAWM, Knol DL, Dekker J, et al. Quality criteria were proposed for measurement properties of health status questionnaires. *J Clin Epidemiol* 2007;60:34–42. doi:10.1016/j.jclinepi.2006.03.012.
- [37] Cronbach LJ, Shavelson RJ. My Current Thoughts on Coefficient Alpha and Successor Procedures. *Educ Psychol Meas* 2004;64:391–418. doi:10.1177/0013164404266386.
- [38] Mohajan HK. Two Criteria for Good Measurements in Research: Validity and Reliability. *Ann Spiru Haret Univ Econ Ser* 2017;17:59–82. doi:10.26458/1746.
- [39] Usp N, Winter SEM. Some Clarifications and Recommendations on Fit Indices. *Newsom* 2012:1–4.
- [40] Yong AG, Pearce S. A Beginner’s Guide to Factor Analysis: Focusing on Exploratory Factor Analysis. *Tutor Quant Methods Psychol* 2013;9:79–94. doi:10.20982/tqmp.09.2.p079.
- [41] Matsunaga M. How to Factor-Analyze Your Data Right: Do’s, Don’ts, and How-To’s. *Int J Psychol Res* 2010;3:97–110. doi:10.4090/juee.2008.v2n2.033040.
- [42] Anderson JFHJWCBBJBRE. *Univariate Data Analysis*. 2014. doi:10.1007/978-3-319-01517-0\_3.

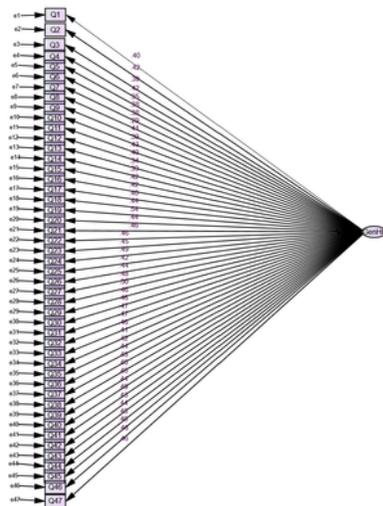
## Tables

Due to technical limitations, Tables 1 - 4 are only available for download from the Supplementary Files section.

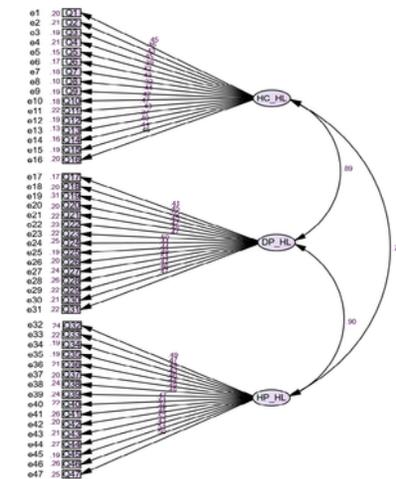
# Figures

Factor loadings of the items in HLS-Amh (GEN-HL) and the three sub dimensions (HC-HL, DP-HL and HP-HL)

Item no	HLS-Amh (GEN-HL)	HC-HL	DP-HL	HP-HL
Q1	0.404	0.465		
Q2	0.422	0.470		
Q3	0.390	0.443		
Q4	0.418	0.459		
Q5	0.352	0.398		
Q6	0.384	0.419		
Q7	0.380	0.442		
Q8	0.287	0.333		
Q9	0.406	0.436		
Q10	0.393	0.412		
Q11	0.434	0.476		
Q12	0.403	0.433		
Q13	0.341	0.364		
Q14	0.390	0.377		
Q15	0.417	0.416		
Q16	0.425	0.432		
Q17	0.399	0.413		
Q18	0.439	0.459		
Q19	0.542	0.548		
Q20	0.440	0.461		
Q21	0.459	0.483		
Q22	0.464	0.502		
Q23	0.450	0.491		
Q24	0.489	0.502		
Q25	0.425	0.453		
Q26	0.438	0.435		
Q27	0.481	0.481		
Q28	0.503	0.488		
Q29	0.463	0.436		
Q30	0.456	0.440		
Q31	0.470	0.468		
Q32	0.472	0.471		
Q33	0.457	0.438		
Q34	0.411	0.440		
Q35	0.420	0.414		
Q36	0.439	0.456		
Q37	0.427	0.431		
Q38	0.461	0.489		
Q39	0.463	0.506		
Q40	0.437	0.477		
Q41	0.489	0.500		
Q42	0.433	0.440		
Q43	0.441	0.449		
Q44	0.479	0.536		
Q45	0.396	0.462		
Q46	0.478	0.522		
Q47	0.462	0.517		



a. Factor loadings of the items in HLS-Amh (GEN-HL)



b. Factor loadings of the items in HLS-Amh(HC-HL, DP-HL and HP-HL)

Figure 1: (a) Factor loadings of the items in HLS-Amh (GEN-HL) and (b) the three sub dimensions (HC-HL, DP-HL and HP-HL)

Figure 1

(a) Factor loadings of the items in HLS-Amh (GEN-HL) and (b) the three sub dimensions (HC-HL, DP-HL and HP-HL)

## Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [DatasetSPSSforHealthliteracy.sav](#)
- [Tables1234.docx](#)