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Psychometric Properties of Health Literacy Measure for Adolescents (HELMA) and Predictors of Health Literacy among Youth from Malaysia and Sri Lanka

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ABSTRACT
Health literacy is critical for individual empowerment because it affects how people obtain health information and use it in ways that benefit their health. Healthcare practitioners frequently lack adequate training in health literacy principles. The present study evaluated the psychometric properties of the Health Literacy Measure for Adolescents (HELMA) instrument to assess the health literacy and the predictors of health literacy among youth from Malaysia and Sri Lanka studying at a medical institution. Following ethics clearance, students aged between 18–24 years enrolled in semesters I through V were approached. Following informed consent, using convenience sampling/complete enumeration, i.e., all students were invited to participate. Overall, 315 participants provided complete data. Cronbach's alpha for the HELMA instrument was 0.74. Based on factor loading, Access, Reading, and Self-efficacy were combined under the sub-domain 'Approach.' Health literacy was highest in the domain of 'Numeracy' followed by 'Understanding' and 'Approach'. Lower health literacy was observed among younger students and those in lower semesters while having a health worker in the family significantly improved health literacy among participants. Our findings support the use of the HELMA instrument to assess youth health literacy.

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Introduction

The World Health Organization states that health literacy means achieving a level of knowledge, skills and confidence to take action that improves personal and community health (WHO, 2022).

Health literacy is essential to empower individuals as it has a bearing on how individuals access health information and use it in a manner that positively impacts their health. Health literacy means more than being able to read pamphlets and successfully make appointments (Peerson & Saunders, 2009). It empowers individuals giving them the confidence and assurance in understanding some basic but crucial aspects of health promotion for themselves, their families and their communities (McQueen et al., 2007; Nielsen-Bohlman et al., 2004). Thus, it influences health outcomes and the level of health costs in the community (Nielsen-Bohlman et al., 2004; Sørensen et al., 2012). Health literacy is influenced by social, cultural, and individual factors (Nielsen-Bohlman et al., 2004). Prevalence of low health literacy is observed across all age groups (Khajouei & Salehi, 2017; Lamanauskas & Augienė, 2019) and a lack of health literacy among people can lead to an increase in healthcare expenditure (Rasu et al., 2015).

Health literacy among youth is of great importance as they begin to make independent health decisions and manage their own health. Youth are considered to be one of the most important age groups in a community as they are the future (Bröder et al., 2017; Humaid et al., 2019). This age group has been defined by the United Nations as persons between the age of 15 to 24 (UN, 2018). Despite having access to affordable internet access, it has been reported that the youth of today tend to neglect their health and are poorly informed about health literacy (Matar Boumosleh & Jaalouk, 2017; Rathnayake & Senevirathna, 2019; University of Minnesota, 2007).

Research among healthcare profession students indicates that they often have inadequate training in health literacy (Coleman, 2011) which exacerbates their impact on patients with low health literacy. It has been suggested that medical students' lack of health literacy training contributes significantly to this disparity in knowledge and abilities, as well as their inability to be effective providers of patient-centred and high-quality care (Mullan et al., 2017). Strengthening healthcare providers' health literacy could have a beneficial impact on their individual patient-provider encounters (Brooks et al., 2020; Budhathoki et al., 2019; Cafiero, 2013; Mackert et al., 2011)

Studies related to health literacy are limited in Sri Lanka and Malaysia. A study in rural Malaysia concluded that the health literacy level among 50% of the adults in the general population was very limited (Norrafizah et al., 2016). Similarly, Jaafar et al. (2021) explored the prevalence of health literacy among Malaysian adults and found that the health literacy level fell at the lower end of the sufficiency category. Among the age group 18-24 years, around 39% had limited health literacy. Rathnayake and Senevirathna (2019) from Sri Lanka reported that 49% of Nursing students had unsatisfactory eHealth literacy skills. eHealth literacy refers to an individual's ability to obtain, understand, and appraise health information from electronic resources and applying that knowledge to solve health problems (Norman & Skinner, 2006). These findings are comparable with those of a study among 1369 young university students from the streams of Nursing, Islamic Sciences and Law in Turkey which showed that 45% of the students had problematic health literacy levels which were furthermore predicted by gender and health education (Uysal et al., 2020). A study among students from the fields of Nursing and Education at the Universities of Girona and Barcelona (Spain), and the Regional Institute of Social Work in Perpignan, reported that only 37% of Health and Social Care University students exhibited sufficient health literacy (Juvinyà-Canal et al., 2020). This was further differentiated based on the course that the student pursued with Nursing students having higher health literacy in comparison with Social Work and Primary and Special Education students. A study set in Amsterdam that sampled youth from multiple ethnicities including Dutch, African Surinamese, South-Asian Surinamese, Ghanaian, Turkish and Moroccan, assessed health literacy. The findings suggested that performance-based health literacy, i.e., a performance-based recognition and pronunciation test, that evaluates participants' ability to read from a list of 66 health-related terms, was low only among 17% participants, which was comparatively better than for participants in studies from the south Asian context. Furthermore, on adjusting for educational level, Dutch participants performed better than participants from Ghanaian, Turkish or Moroccan backgrounds.

Educational exposure in a developed-country setting may contribute to such findings (Blom et al., 2018).

In comparison, undergraduate students from a research institute in the US had a mean health literacy score of 94% (Ickes MEd et al., 2010) which was much higher than scores among youth from developing countries. There exists a dearth of studies related to health literacy among youth (Bröder et al., 2017; Diamond et al., 2011) in the developing country context and instruments that are appropriate to assess health literacy among them. In the context of COVID-19, health literacy among medical students necessitates further exploration as they should be able to acquire and use relevant health information.

The Health Literacy Measure for Adolescents (HELMA) is an easy-to-administer instrument developed by Ghanbari et al. (2016) to assess health literacy among Iranian adolescents aged 15-18 years. It was found to have a good reliability score with Cronbach's α of 0.93. Following its development, this instrument has been used by researchers among other samples of Iranian adolescents (Saeedi et al., 2016; Dehghankar et al., 2019; Karimi et al., 2019). Saeedi et al. (2016) and Dehghankar et al. (2019) used HELMA to determine the level of health literacy and factors influencing it among high school pupils in Tehran and Qazvin. Saeedi et al. (2016) found that 37.5% of high school pupils showed inadequate health literacy, which was significantly correlated with the Year level, the education of the parents, sources of information, health status and interest in health-related topics. Dehghankar et al. (2019) state that 31% of female high school pupils had inadequate health literacy in their study. Health literacy in this study too had a statistically significant relationship with educational level and interest in health-related topics; however, there was no relationship with other demographic variables such as parental education or health status.

Most instruments that assess health literacy are designed for children, adolescents or adults or are aimed at assessments in clinical settings with few targeting the general population (Massey et al., 2013). Youth constitute a vital target group in relation to their health behaviours. With regard to medical students, their choices and behaviour stemming from their health literacy could potentially have an impact on their patients. Although health literacy has been in focus in recent decades, instruments to explore health literacy specifically among youth are limited. Systematic reviews have explored instruments measuring health literacy, but their methodological deficiencies have not been sufficiently explored and critical appraisals are lacking (Guo et al., 2018). Moreover, at the present time, the best instrument to determine the health literacy of youth is uncertain (Diamond et al., 2011). With the COVID-19 pandemic impacting countries around the world, these limitations spur the need to further explore appropriate instruments that would assess health literacy among medical students.

Our study differs from existing literature in that it was undertaken to evaluate the psychometric properties of the HELMA instrument. This study also assessed health literacy and its predictors among youth from two countries, Malaysia and Sri Lanka, who were studying at a medical institution. The results gained from this study will contribute to the corpus of knowledge on the usefulness of the HELMA instrument among medical students outside Iran. Hence, this study aimed at evaluating the psychometric properties of the HELMA instrument. We further assessed the level of health literacy and its predictors among the participants.

Research Questions

1. What are the psychometric properties of the HELMA instrument among medical students aged 18-24 years?
2. What is the level of health literacy among medical students from Malaysia and Sri Lanka?
3. What are the predictors of health literacy among medical students from Malaysia and Sri Lanka?

Methods

Ethics

Ethics approval was obtained from the Kasturba Medical College and Kasturba Hospital Institutional ethics committee, MAHE, Manipal.

Design of the Study

We used a cross-sectional survey design. The study was conducted among students undergoing medical training at Manipal, Udupi, through a unique twinning program with shared campuses at Manipal in India and Melaka, Malaysia. The university provides opportunities for international students to acquire a medical degree (Bachelor of Medicine and Surgery, MBBS).

Sampling

The inclusion criteria comprised of participants aged between 18–24 years of age from Malaysia and Sri Lanka who were enrolled at the target institution. The participants were identified with the help of class representatives from lists maintained at the medical institution. The participants were studying in semesters I through V at the time of data collection. We used convenience sampling method which is a form of non-probability sampling. All participants were provided informed consent prior to data collection. Total enumeration was attempted, and 400 participants were invited to participate. Overall, 315 provided completed questionnaires. The data collection spanned between January to April 2020.

Instrument and Data Collection

The HELMA instrument as well as a socio-demographic pro forma were the instruments used for data collection. Demographic characteristics of the study participants, such as age, gender, current semester, nationality and presence or absence of a healthcare professional in the immediate family were also recorded. The HELMA tool consisted of 44 items placed under eight areas including access, reading, understanding, appraisal, use, communication, self-efficacy and numeracy. The items 1-41 followed five-point Likert scale (Never=1, Rarely=2, Sometimes=3, Usually=4, Always=5). The last three items under numeracy were tested using mathematical calculation. The authors of the HELMA tool ranked the HELMA score into 4 categories: 'inadequate' and 'problematic', together defined as 'limited' health literacy and they categorized 'sufficient and 'excellent' together as 'desired' health literacy which we incorporated in our study.

Potential participants were met on campus between sessions by the research team and invited to participate. The participants were requested to complete the questionnaires without discussing the questions with their peers. They were assured that there were no 'right' or 'wrong' answers and that we were interested in obtaining their perceptions and practices related to health literacy. The data were collected anonymously to maintain confidentiality.

Statistical Analysis

SPSS version 25 was used for analysis. The psychometric properties of HELMA were evaluated using construct validity and reliability. Descriptive analysis was performed, and data were

presented in the form of frequency and percentages. Associations with socio-demographic factors were assessed using the Chi-square test. Backward stepwise logistic regression was then performed to assess predictors of total HELMA scores.

Construct Validity

Exploratory factor analysis with varimax rotation was used to investigate the construct validity. The criteria used for factor analysis were Eigenvalues above 1.5 and factor loadings greater than or equal to 0.40. The Kaiser-Meyer-Olkin (KMO) and Bartlett's Test of Sphericity were performed to evaluate the suitability of the sample for the factor analysis.

Reliability

Internal consistency was assessed to determine the reliability of the instrument following factor analysis. Cronbach's alpha was used to determine internal consistency. This was assessed for each of the domains as well as for the scale as a whole.

Results

Socio-Demographic Data

Table 1

Socio-Demographic Profile of Participants (N = 315)

Characteristics		n (%)
Age in years	18-20	30 (9.5%)
	21-22	153 (48.6%)
	>22	132 (41.9%)
Semesters	Ist-IInd	178 (56.5%)
	IIIrd-IVth	101 (32.1%)
	Vth	36 (11.4%)
Gender	Male	105 (33.3%)
	Female	210 (66.7%)
Nationality	Malaysian	259 (82.2%)
	Sri Lankan	56 (17.8%)
Healthcare professional in the family	Yes	137 (43.5%)
	No	178 (56.5%)

A total of 315 students participated of whom, 210 (66.7%) were female and 105 (33.3%) were male. Overall, 56.5% were enrolled in the Ist and IInd semesters while the lowest number of participants were from the Vth semester (11.4%). Most participants belonged to the age group of 20-22 years (48.6%). With regard to nationality, most participants were Malaysian (82.2%) and the rest were Sri Lankan. While a relatively large number of participants (43.5%) had at least one family member who worked as a healthcare professional, others did not (56.5%). The socio-demographic data are presented in Table 1.

Psychometric Properties of HELMA

The HELMA instrument consisted of 44 items. Exploratory factor analysis was conducted for 41 items. The remaining 3 items, which belonged to the Numeracy section had a different scoring system, hence they were not included. The KMO test value of 0.916 and Bartlett's test were found to

be statistically significant ($p < 0.001$). It showed that the sampling was adequate and variances were equal (i.e., homogeneous) across groups. This revealed the appropriateness of the sample for the factor analysis. Five factors were emerged which explained 54.28% of the variance. Forty items were loaded uniquely on one of the five components. However, one item, *"I can discuss my concerns relating to health issues with health providers"* cross-loaded, and it was located with higher component loading. The items related to the areas self-efficacy, access and reading merged and became one component (14 items) and it was named 'approach.' Factor loading patterns of the areas, understanding (10 items), appraisal (5 items), and use (4 items), were consistent with the original HELMA item set. However, the item *"I talk to my friends about avoiding risky behavior (e.g., smoking, hookah, drugs, etc.)"* which originally belonged to the communication area did not load on any of the components, and it was dropped from the questionnaire. Hence, in this study, the communication component had only seven items instead of eight. This is presented in Table 2.

Table 2

Factor Loadings of the Items on Each Component

Items	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
1. I try to get more information about health as much as possible	0.45				
2. I am able to find health information that I need	0.53				
3. When ill or facing health problems, I can get the necessary information I need	0.53				
4. I am able to ask others about health information that I need	0.52				
5. I am able to access information about the healthy diet that is appropriate for my age group	0.69				
6. I am able to access information about the physical activity appropriate for my age group	0.66				
7. I am able to access information about the proper care required for my skin and hair that is appropriate for my age group	0.59				
8. I am able to access information about mental health appropriate for my age group	0.61				
9. I am able to find useful resources about health Information on the Internet	0.61				
10. I can read brochures on prescribed medicine	0.67				
11. I can easily read educational brochures about nutritional issues	0.74				
12. I can easily read brochures/fact sheets about disease prevention (e.g. anaemia, osteoporosis, respiratory infections, etc.)	0.75				
13. I can easily read health information materials in magazines and newspapers	0.69				
14. I can easily read health information materials on the Internet (e.g. websites)	0.58				
15. I can easily understand the meaning of the signs used in hospitals and medical centres		0.62			

16. I can understand most things I hear about health	0.63		
17. I can easily understand the content of health information that I find	0.66		
18. I can easily understand my doctor's instructions and recommendations (e.g. prescriptions)	0.72		
19. I can easily understand information about medications – usage, side effects and warnings	0.65		
20. I can easily understand the nutrition facts on food packages	0.6		
21. I can understand the information and recommendations about proper nutrition for adolescents in the media (e.g. radio, TV, internet, etc.)	0.70		
22. I can understand the information and warnings provided by the media (e.g. radio, TV, internet, etc.) about tobacco, drug abuse and risky behaviours	0.71		
23. I can understand the information and recommendations about health and illness in the media	0.74		
24. I can understand the recommendations on prevention of accidents and injuries	0.72		
25. When faced with new health information, I can judge its accuracy		0.67	
26. I would compare the data obtained from various sources		0.62	
27. When dealing with conflicting information about health issues, I can recognise the correct information		0.79	
28. I have the ability to judge which resources I can trust		0.74	
29. When dealing with nutritional information I can choose the right information		0.62	
30. When shopping, I choose food based on its nutrition facts (e.g. amount of energy, sugar, protein, etc.) written on the packaging			0.8
31. I try to choose foods without preservatives			0.82
32. I try to apply what I have learned about health issues in my everyday life			0.67
33. I try to keep my body weight in balance			0.56
34. I can discuss my concerns relating to health issues with health providers	0.54		0.42
35. When visiting a doctor or health provider I am able to give him/her all of my necessary personal information	0.57		
36. When visiting a doctor or health provider I am able to tell him/her the name of the medications that I have previously used	0.57		

37. When visiting a doctor or health provider I am able to ask all the questions I have			0.64		
38. I can share the health information that I gather with others (e.g. family, friends, etc.)			0.7		
39. If I have any questions about health issues I am able to get information and advice from others			0.64		
40. When visiting a doctor or health provide I am able to ask questions based on my research			0.59		
41. I talk to my friends about avoiding risky behaviour (e.g. smoking, hookah, drugs, etc.)	did not load in any scale				
Eigenvalue	13.32	2.85	2.60	1.97	1.51
Explained Variance (%)	15.38	14.67	9.23	8.14	6.87
Cumulative Variance (%)	15.38	30.05	39.27	47.41	54.28

Reliability: Cronbach α

The internal consistency (Cronbach α) for the subdomains and the total HELMA score were as follows: Approach 0.91, Understanding 0.91, Appraisal 0.71, Use 0.79, Communication 0.83, Numeracy 0.60, and Total score: 0.74.

The access, reading and self-efficacy domains were combined under the domain of 'approach.' On assessing, 'comprehension' was marginally lower (50.2%) than the desirable score. Desirable scores were obtained under the domains of 'understanding' and 'numeracy'. Participants scored higher under the limited category in the domains of 'appraisal,' 'use,' and 'communication.' Under the 'total score,' participants scored marginally higher under the limited category. Table 3 depicts the scores obtained under each HELMA score.

Health Literacy of Participants

Table 3

Domains of HELMA Score

Domain	Limited	Desirable
Approach*	158 (50.2%)	157 (49.8%)
Understanding	121 (38.4%)	194 (61.6%)
Appraisal	213 (67.6%)	102 (32.4%)
Use	230 (73%)	85 (27%)
Communication	175 (55.6%)	140 (44.4%)
Numeracy	41 (13%)	274 (87%)
Total Score	165 (52.3%)	150 (47.7%)

Note. Approach Access+reading+self-efficacy*

Table 4

Associations between the Sociodemographic Factors and Domains of HELMA

Variables	Domains		p-value<0.05
	Approach		
Age in years	Limited	Desirable	
18-20	21 (70%)	9 (30%)	
21-22	80 (52.3%)	73 (47.7%)	0.023
>22	57 (43.2%)	75 (56.8%)	
	Understanding		
18-20	16 (53.3%)	14 (46.7%)	
21-22	64 (41.8%)	89 (58.2%)	0.037
>22	41 (31.1%)	91 (68.9%)	
	Use		
18-20	25 (83.3%)	5 (16.7%)	
21-22	118 (77.1%)	35 (22.9%)	0.043
>22	87 (65.9%)	45 (34.1%)	
	Communication		
18-20	21 (70%)	9 (30%)	
21-22	92 (60.1%)	61 (39.9%)	0.021
>22	62 (47%)	70 (53%)	
	Total score		
18-20	22(13.3%)	8 (5.3%)	
21-22	87 (52.7%)	66 (44%)	0.003
>22	56 (33.9%)	76 (50.7%)	
Semesters	Approach		
I^{st}-II^{nd}	99 (55.6%)	79(44.4%)	
III^{rd}-IV^{th}	51 (50.5%)	50 (49.5%)	0.001
V^{th} Semester	8 (22.2%)	28 (77.8%)	
	Understanding		
I^{st}-II^{nd}	85 (47.8%)	93 (52.2%)	<0.0001
III^{rd}-IV^{th}	31 (30.7%)	70 (69.3%)	
V^{th} Semester	5 (13.9%)	31 (86.1%)	
	Use		
I^{st}-II^{nd}	136 (76.4%)	42 (23.6%)	<0.0001
III^{rd}-IV^{th}	78 (77.2%)	23 (22.8%)	
V^{th} Semester	16 (44.4%)	20 (55.6%)	
	Appraisal		
I^{st}-II^{nd}	128 (71.9%)	50 (28.1%)	
III^{rd}-IV^{th}	71 (70.3%)	30 (29.7%)	<0.0001
V^{th} Semester	14 (38.9%)	22 (61.1%)	
	Communication		
I^{st}-II^{nd}	106 (59.6%)	72 (40.4%)	
III^{rd}-IV^{th}	58 (57.4%)	43 (42.6%)	0.005

Vth Semester	11 (30.6%)	25 (69.4%)	
	Total score		
Ist-IInd	104(63%)	74 (49.3%)	
IIIrd-IVth	50 (30.3%)	51 (34%)	0.007
Vth Semester	11 (6.7%)	25 (16.7%)	
Gender	Understanding		
Male	50 (47.6%)	55 (52.4%)	
Female	71 (52.4%)	139 (47.6%)	0.03
Healthcare professional in the family	Approach		
Yes	58 (42.3%)	79 (57.7%)	0.015
No	100 (56.2%)	78 (43.8%)	

Table 4 depicts the significant findings on Chi-square test for the association between exposure and outcome variables. The age of the participants was significantly associated with the domains of approach, understanding, use, communication and total score. The semesters that the participants were currently studying in significantly associated with the domains of approach, understanding, use, appraisal, communication, and total score. The gender of the participants was significantly associated with the domain of understanding. Presence of a healthcare professional in the family of the participant was significantly associated with the domain of approach domain. There were no significant associations between the nationality of the participant and domains of HELMA.

Table 5

Predictors of Total HELMA Score

Variables	COR 95% CI*	p-value	AOR** 95% CI	p-value <0.05
Age in years				
18-20	0.27(0.11-0.65)	0.003	0.33(0.13-0.83)	0.019
21-22	0.56(0.35-0.89)	0.015	0.81(0.45-1.47)	0.49
>22	1		1	
Gender				
Male	0.71(0.44-1.14)	0.15		
Female	1			
Semester				
Ist-IInd	0.31(0.14-0.66)	0.003	0.35(0.14-0.87)	0.028
IIIrd-IVth	0.45(0.20-1.01)	0.052	0.17(0.23-1.28)	0.17
Vth Semester	1		1	
Healthcare professional in the family				
Yes	1.75(1.12-2.75)	0.015	1.97(1.22-3.16)	0.005
No	1		1	

Note. *CI – Confidence interval, **AOR – Adjusted odds ratio

Backward logistic regression was then performed to identify the predictors. Univariate and multivariate analyses of predictors were conducted. The following factors were found significant on univariate analysis and were adjusted on multivariate analysis: age in years, gender of the participants, the batch that the participants were currently in, and having a health professional in the family.

On multivariate analysis, all three variables except for gender emerged as significant predictors of the total HELMA score. Table 5 presents the predictors of the total HELMA score.

The age of the participants was also a significant predictor of the total HELMA score. In comparison with the oldest participants (>22 years), the youngest participants aged 18-20 years were found to have a lower likelihood of obtaining a desirable total HELMA score [AOR 0.33 95% CI (0.13-0.83), p=0.019].

With regard to the semester in which the student was studying currently, in comparison with the students in semester V; the Ist and IInd semester students were found to have a lower likelihood of obtaining a desirable total HELMA score [AOR 0.35, 95% CI (0.14-0.87) p=0.028].

Having a healthcare professional in the family was another significant predictor of the total HELMA score. Those who did have at least one family member engaged in the healthcare profession were found to have higher odds of scoring in the desirable range of the total HELMA score [AOR 1.97 95% CI (1.22-3.16), p=0.005].

Discussion

Healthcare providers require a wide range of skills to improve their own self-care as well as the autonomy, engagement and self-management abilities of their patients. Medical students may serve as role models for the public to embrace preventative health behaviours. This study attempted to psychometrically evaluate the HELMA instrument (Ghanbari et al., 2016) and to measure the predictors of health literacy among international students from two countries studying at a medical school in India. Given the need for and the present dearth of instruments that assess health literacy among youth, (Manganello, 2008) we evaluated the psychometric properties of the instrument to assess both individual and interpersonal factors as described by Ghanbari et al. (2016) except that the age group was extended to include youth. Following factor analysis and reliability assessment, the health literacy measure consisted of 43 items within 6 areas. The domains of access, reading, and self-efficacy with a total of 14 items were reduced to one domain which was renamed the approach domain. The domains of understanding, appraisal, use, and numeracy remained the same. Item 41 belonging under domain of communication did not load on any of the components. In all, 43 items were retained. The questionnaire was self-administered and the participants were able to complete it within about 15-20 minutes. The available instruments that assess health literacy target specific population groups (Shah et al., 2017; Attygalle et al., 2017; Denuwara & Gunawardena, 2017) or have limitations in assessing health literacy among youth (Guo et al., 2018). Given these findings, the study provides evidence supporting the usefulness of the HELMA instrument for assessing health literacy among youth.

The HELMA instrument has been used in prior studies (Dehghankar et al., 2019; Karimi et al., 2019; Naghavi et al., 2021; Saeedi et al., 2016) that have largely concentrated on adolescent populations in schools. Our study is one of the first of its kind thus far to have evaluated the properties of this instrument among youth in the 18-24 age group. Among the adolescent participants in Iran, Ghanbari et.al. (2016) reported on the psychometric properties of the HELMA instrument and observed that eight factors were loaded accounting for about 53.7% of the observed variance with approved reliability of α = 0.93 with test-retest Intraclass Correlation Coefficient of 0.93 showing satisfactory stability. In comparison, on testing the psychometric properties of the HELMA instrument among our participants, it was found to have both acceptable validity and reliability; however, the factor structures differed slightly from the original instrument which could be attributed to the difference in populations. It was observed that one item did not load onto any of the

five factors. This item was related to talking to friends about avoiding risky behaviours such as smoking, hookah and drugs. Given the conservative nature of the South Asian culture, such topics may have been avoided. Social norms may have also dictated the development of smoking-related stigma.

The increasing exposure to anti-tobacco and anti-drug campaigns may have contributed to negative beliefs about such practices and avoidance of discussing these topics with peers. These attitudes have been elicited in both the Malaysian (Parkinson et al., 2009) and Sri Lankan contexts (Fernando et al., 2010). The domains identified in our study are presented in Table 3.

Zhang et al. (2016) stated that low health literacy is associated with higher mortality and lower knowledge regarding disease conditions. It could also be related to higher costs to maintain health. The HELMA instrument has not been used hitherto among youth and hence, we could not do a direct comparison with previous literature. Other studies have used alternative instruments to assess health literacy among their youth. Juvinyà-Canal et al. (2020) in their study among students from Spain and France showed that the majority had limited health literacy although it was higher than in our study. About half of the participating Nursing students from Sri Lanka had inadequate eHealth literacy (Rathnayake & Senevirathna, 2019) which is comparable to our study. In our study, as the semesters advanced, the desirable health literacy increased. It could be further improved by incorporating mandatory health literacy training into the curriculum as suggested by Coleman (2011).

The participants in the current study were medical students and expected to acquire adequate health literacy while undergoing the curricula. Hence, variables such as interest in health topics, health status, and the source of information which were used by the past researchers were not included (Saeedi et al., 2016; Dehghankar et al., 2019). Parents' education was included by some researchers as a variable; however, there were no consistent outcomes (Saeedi et al., 2016; Dehghankar et al., 2019). Hence, we did not add these as variables in our study.

On assessing for predictors, we found that the age of the participants predicted the total HELMA score. The younger participants had a lower likelihood of obtaining a desirable HELMA score overall in comparison with the older participants. Rababah et al. (2019) in their study among youth with a mean age of 21.03 years (±2.29) from Jordan showed a significant association of lower health literacy with age, year of study and the field of study with participants from health-related faculties scoring better than those in our courses of study. Given that our participants were from the medical field, it was of note to find the differences between the younger and older participants. Hanik and Stellefson (2011) in their study among health education students from a Southwestern University in the USA found that eHealth literacy among them was not adequate, especially among those will 'less academic experience.' A study set in China among youth in vocational colleges showed that the class year was significantly associated with health-related knowledge (Wang et al., 2014). These findings were reflected by a study among medical students in Chongqing, China, where freshman students scored the lowest on health literacy. Regression analysis revealed that the year level students were enrolled at was a significant predictor of health literacy scores (Zhang et al., 2016). Our findings correspond with these findings among youth from Jordan, USA and China in that participants from the lower semesters, i.e., semesters I-II, typically were of a younger age and had less exposure to health information. Hence, they had a lower likelihood of obtaining a desirable HELMA score in comparison with those in semester V who may have had higher exposure to medical sciences in later semesters. Therefore, our findings are comparable with the findings in other settings.

Interestingly, we also found that having a healthcare professional in the immediate family predicted higher odds of scoring in the desirable range of the total HELMA score of up to 1.97 times in comparison with those that did not have a health professional in their family. This is consistent with the finding of the National Bureau of Economic Research that having a health professional/health worker in the family significantly promotes health outcomes. This could be due

to greater engagement in preventive healthcare which could explain higher literacy among our participants who had an immediate family member in the health profession (NBER, 2019).

Conclusions and Recommendation

The novelty of our study was that we evaluated the psychometric properties of the HELMA instrument among youth in a medical program which has not been conducted previously.

Health literacy was highest in the domains of 'Numeracy' followed by 'Understanding' and 'Approach'. Pertinent study findings included lower health literacy among younger medical students and those in lower semesters as compared with the higher (V^{th}) semester students. Having a health professional in the family significantly improved health literacy among participants. Factor analysis supports the use of the HELMA instrument among youth. Our findings indicate that the level of health literacy among youth needs improvement. There is a need to introduce a targeted health literacy module within the medical curriculum that may better inform students and groom them to become better practitioners. The earlier these concepts are introduced, the easier they may be to include in practice in the future. Given the recent global experience with COVID-19 and the threat of further outbreaks in the future, improving health literacy among young health professionals is an urgent need.

Limitations

As we recruited participants from a single medical institution, our findings may not be generalizable. The use of self-administered questionnaires may have led to response bias on the part of the participants. Also, as semester V students were engaged in clinical postings, their participation may have been affected.

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