


## Digital health literacy of nursing or medical students: related factors

Letramento digital em saúde de estudantes de enfermagem ou medicina: fatores relacionados

Alfabetización digital en salud de estudiantes de enfermería o medicina: factores relacionados

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## Abstract

**Objective:** To identify factors related to the digital health literacy of medical or nursing students.

**Methods:** The level of digital health literacy of undergraduate nursing or medical students from three institutions was assessed using the Brazilian version of the eHealth Literacy Scale (eHEALS), whose score ranges from 8 to 40; the higher the score, the higher the self-reported literacy level. Relationships between the eHEALS score and sociodemographic and academic variables were assessed using the Mann Whitney or Kruskal Wallis tests, with a significance level of 5%. When the Kruskal Wallis test was significant, the Dunn's test was used for two by two comparisons.

**Results:** 346 students participated in the study, with a mean age of  $23.0 \pm 5.0$  years, 71.5% female, 51.6% from the Nursing course. The mean eHEALS score was  $31.6 \pm 4.4$ . Higher eHEALS scores were associated with the male gender, attending a public institution, full-time course, longer time since enrollment in the course, having close people who seek health information online, mastering another language, and feeling good/very good about their current health. The literacy level was positively correlated with age, and the usefulness of the internet and its health content. Lower scores were reached in the item "I feel confident in using information from the internet to make health decisions".

**Conclusion:** Sociodemographic and academic characteristics are related to the digital health literacy of university students. These results can support and direct curricular efforts in universities, engaging future health professionals in the dissemination of reliable information inside and outside the academic context, and in technology-assisted care.

## Resumo

**Objetivo:** Identificar fatores relacionados ao letramento digital em saúde de estudantes de medicina ou enfermagem.

**Métodos:** O nível de letramento digital em saúde de graduandos de enfermagem ou medicina de três instituições foi avaliado pela *eHealth Literacy Scale* (eHEALS), versão brasileira, cujo escore varia de 8 a 40; quanto maior a pontuação, maior o nível de letramento autorreferido. Relações entre o escore do eHEALS e variáveis sociodemográficas e acadêmicas foram verificadas por meio dos testes de Mann Whitney ou Kruskal Wallis, com significância de 5%. Quando havia significância do teste de Kruskal Wallis, foi utilizado teste de Dunn para comparações dois a dois.

**Resultados:** Participaram 346 estudantes, com idade média de  $23,0 \pm 5,0$  anos, 71,5% do sexo feminino, 51,6% do curso de Enfermagem. A pontuação média do eHEALS foi de  $31,6 \pm 4,4$ . Maiores escores do

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eHEALS se associaram a: sexo masculino, instituição pública, curso integral, maior tempo desde o início da graduação, ter pessoas próximas que buscam informações sobre saúde *online*, dominar outro idioma, se sentir bem/muito bem sobre a saúde atual. O nível de letramento se correlacionou positivamente com idade, utilidade da internet e seu conteúdo de saúde. O item “Sinto-me confiante em usar informações da Internet para tomar decisões de saúde” teve pontuação mais baixa.

**Conclusão:** Características sociodemográficas e acadêmicas se relacionam ao letramento digital em saúde de estudantes universitários. Esses resultados podem subsidiar e direcionar esforços curriculares nas universidades, engajando futuros profissionais da saúde na disseminação de informações confiáveis dentro e fora do contexto acadêmico, bem como na assistência assistida por tecnologias.

## Resumen

**Objetivo:** Identificar factores relacionados a la alfabetización digital en salud de estudiantes de medicina o enfermería.

**Métodos:** El nivel de alfabetización digital en salud de estudiantes universitarios de enfermería o medicina de tres instituciones fue evaluado por la *eHealth Literacy Scale* (eHEALS), versión brasileña, cuya puntuación varía de 8 a 40; cuanto más alta la puntuación, más alto el nivel de alfabetización autorreferido. La relación entre la puntuación de eHEALS y variables sociodemográficas y académicas se verificó a través de las pruebas de Mann Whitney o de Kruskal Wallis, con una significancia del 5 %. Cuando había significancia en la prueba de Kruskal Wallis, se utilizó la prueba de Dunn para comparaciones de a dos.

**Resultados:** Participaron 346 estudiantes, de edad promedio de  $23,0 \pm 5,0$  años, 71,5 % del sexo femenino, 51,6 % del curso de Enfermería. El puntaje promedio del eHEALS fue de  $31,6 \pm 4,4$ . Las puntuaciones más altas de eHEALS se asociaron con: sexo masculino, institución pública, curso integral, más tiempo desde el inicio del curso universitario, tener a personas próximas que buscan información sobre salud *online*, dominar otro idioma, sentirse bien/muy bien sobre la salud actual. El nivel de alfabetización se correlacionó positivamente con la edad, utilidad de internet y su contenido de salud. El ítem “Me siento seguro al usar información de internet para tomar decisiones de salud” obtuvo un puntaje más bajo.

**Conclusión:** Características sociodemográficas y académicas se relacionan con la alfabetización digital en salud de estudiantes universitarios. Esos resultados pueden respaldar y orientar iniciativas curriculares en las universidades, y así involucrar a futuros profesionales de salud en la disseminación de información confiable dentro y fuera del contexto académico, así como a la atención auxiliada por tecnologías.

## Introduction

Brazilian data from 2020 and 2021 show that 81% of the population use the internet, which corresponds to 152 million people.<sup>(1)</sup> In this reality, through interaction on social networks, feelings of empowerment, security and freedom have been enhanced by individual production of mass-reaching messages,<sup>(2,3)</sup> including health-related content. In 2020 and 2021, 53% of internet users sought information about health or health services, compared to 47% in 2019.<sup>(1)</sup>

This ease of access to health information – but not necessarily its understanding, evaluation and correct application – influences the health care of individuals and their communities.<sup>(4)</sup> A systematic review of the literature showed that different types of information to guide decisions are sought in online support groups and social media to the detriment of online tools with credibility. In these support groups, sharing of personal advice is more frequent than sharing of knowledge and guidelines. Furthermore, much of the health content generated by users on social media, such as YouTube and Twitter, is inconsistent with clinical guidelines or scientific evidence.<sup>(2)</sup>

In this context, it is essential that individuals have the skills to adequately deal with information,

including digital health literacy (DHL). Norman & Skinner define DHL as “(...) the ability to search, find, understand and evaluate health information from electronic sources, integrate and apply the knowledge acquired in solving a health problem”.<sup>(5)</sup>

Among health professionals in particular, DHL is a prerequisite for the successful digital transformation of health and, therefore, it has an essential place during training, when professionals need to develop skills and competences to assist using digital resources. However, there is a significant gap between university students’ desire to become key actors in the significant digitalization of health and the competences and skills acquired in their courses.<sup>(6)</sup>

Thus, the training and capacity building of human resources for Digital Health is one of the priorities of the Action Plan for Digital Health 2020-2028 in Brazil. Universities and training centers are relevant actors in this strategy, especially in the context of the COVID-19 pandemic and post-pandemic<sup>(7)</sup>, which boosted the search for information related to online health and teleconsultation services in order to reduce the flow and unnecessary referrals of patients to health units, and reach populations far from diagnostic and therapeutic centers.<sup>(8-10)</sup>

The literature on the DHL of medical students is limited. An Irish study showed that these students’ abil-

ities to manipulate digital media, search for information online, engage in social activities on digital platforms and use applications on mobile devices were high, while their ability to create online content was lower.<sup>(11)</sup> In Germany, medical students were able to find reliable health-related information online using medical terms and trusted website names in search engines.<sup>(12)</sup>

Regarding nursing students in Iran and Sri Lanka, they consider the internet a useful or very useful tool to help them in health related decision-making and use it to search for information about symptoms of diseases, physical condition, existing treatments and diagnoses.<sup>(13-15)</sup> However, in Sri Lanka, up to 49.4% of nursing students report inadequate DHL skills<sup>(16)</sup> and in South Korea, students do not feel able to use information from the internet to make health decisions.<sup>(14)</sup> In Jordan,<sup>(17)</sup> nursing students have a moderate level of self-perception regarding DHL. Similarly, in Nepal, they have a moderate level of self-perception regarding DHL and 44.7% had average online skills.<sup>(15)</sup> Studies also indicate that undergraduate nursing students consider they have little or inadequate ability to differentiate between a high-quality and a low-quality online health resource.<sup>(14,16,17)</sup>

Some factors can influence the DHL, including personal determinants (e.g., age, family income and education), relational determinants (e.g., language and cultural barriers to health information), knowledge determinants (e.g., level of pre-existing knowledge about the health problem) and technological determinants (e.g., access to technological devices).<sup>(18)</sup> Thus, awareness of the level of DHL and the intervening factors of students in the health field can help direct interventions, including curriculum restructuring of courses. In Brazil, to the best of our knowledge, there are no studies investigating factors related to DHL in nursing or medical students. Thus, the objective of this study was to identify factors related to the DHL of these students.

## Methods

An observational, analytical, cross-sectional study. Data were collected between February 10 and March 31, 2021.

The study was performed in the Nursing and Medicine courses of three higher education institutions: a private institution in the south region (Institution A) and a private institution in the southeast region (Institution B), where Nursing courses take place in the morning and the Medicine course is full-time; and in a public institution in the southeast region (Institution C), where Nursing and Medicine courses are full-time. None of the institutions has specific courses on Informatics or DHL.

The population consisted of nursing and medical students from all institutions. For the convenience sample, students aged  $\geq 18$  years with internet access were considered eligible.

The principal investigators in each institution sent the invitation to participate, the consent form and the link to the online data collection form to the electronic address of each class of the Nursing and Medicine courses of the three institutions. A 15-day response period was set and if there was no return within this period, the link was resent with another 15 days to respond.

The DHL was assessed using the Brazilian version by Barros<sup>(19)</sup> of the eHealth Literacy Scale (eHEALS),<sup>(20)</sup> a scale used worldwide.<sup>(21-23)</sup> It is composed of eight items to measure the individual's self-perception of their knowledge and ability to find information online and apply that information to health issues.<sup>(20,24)</sup> Each item is answered on a five-point Likert scale with answer options ranging from "strongly disagree" to "strongly agree". The final score ranges from 8 to 40, and the higher the score the better the individual's self-perception of comfort when using the internet and the higher the DHL.<sup>(19)</sup>

The eHEALS also includes two additional non-scored items regarding the perception of the usefulness of the internet in helping to make health decisions and the perception of the importance of being able to access health content on the internet. In the original study, adequate evidence of reliability was obtained after application to a sample of 664 individuals: The Cronbach's alpha coefficient was 0.88 and the test-retest correlation was 0.68. In the internal structure validity, only one factor was identified, with loads rang-

ing from 0.60 to 0.84 among the eight items (eigenvalue = 4.48 with 56% of variance explained).<sup>(20)</sup>

In Brazil, the eHEALS was adapted and validated by Barros<sup>(19)</sup> and by Mialhe et al.,<sup>(20)</sup> respectively, with 431 users of social networks and 502 individuals from the general population of a municipality in the countryside of the state of São Paulo. As the Brazilian version by Barros<sup>(19)</sup> was the only one available at the time of data collection, it was used in this study and obtained adequate psychometric properties. The Cronbach's alpha coefficient was 0.90. Similar to the original study, the factor loadings that explain the construct indicated that all items had adequate values, ranging from 0.65 to 0.88 for the one-factor model.<sup>(25,26)</sup>

The variables potentially related to DHL based on the literature<sup>(13-18,27-31)</sup> were investigated, including the importance attributed to health (1: not important at all to 5: very important) and the perception of the current health status (1: very bad to 5: very well), questions included in the eHEALS, although not scored.

The normality of the distribution of variables was assessed using the Shapiro-Wilk test. The relationships between the eHEALS score (dependent variable) and the independent variables were assessed using the Mann Whitney or Kruskal Wallis tests with a significance level of 5%. When the Kruskal Wallis test was significant, the Dunn's test was used for comparisons 2 by 2. The eHEALS reliability for this sample was assessed by calculating the Cronbach's alpha, classified as:  $\leq 0.30$ : very low;  $0.30 < \alpha \leq 0.60$ : low;  $0.60 < \alpha \leq 0.75$ : moderate;  $0.75 < \alpha \leq 0.90$ : high;  $\alpha > 0.90$ : very high.<sup>(27)</sup>

The project was approved by the Research Ethics Committee of the three higher education institutions where it was developed (Opinion numbers 4.459.119/2020; 4.469.547/2020 and 4.595.647/2021). Anonymity and confidentiality were guaranteed to participants and a digital signature of the Informed Consent form was requested.

Results

Data from 346 students were collected. Their mean age was 23.0±5.0 years, 269 (71.5%) were female

and 194 (51.6%) were from the Nursing course. A total of 104 students (30.1%) were from Institution A, 131 (34.8%) from Institution B and 109 (31.5%) from Institution C. Most students attended full-time courses and mastered another language, 221 (63.9%) and 251 (72.5%), respectively. The mean eHEALS score was 31.6±4.4. Table 1 shows the students' relationship with health content on the internet, its reliability and application. The item with the lowest score was "I feel confident in using information from the internet to make health decisions". Regarding the eHEALS questions not considered for the DHL total score, "How useful do you feel the internet is in helping you making decisions about your health?" reached an average score of 4.1±0.7. Concurrently, "How important is it for you to be able to access health resources on the internet?" had a mean score of 4.5±0.6, consistent with full agreement. The internal consistency of eHEALS in this study was high (Cronbach's alpha=0.90).

**Table 1.** Mean scores of each item of the eHealth Literacy Scale according to responses from nursing and medical students (n=346)

eHEALS items	Score	
	Mean	SD
1. I know what health resources are available on the internet	3.8	0.8
2. I know where to find helpful health resources on the internet	4.1	0.8
3. I know how to find helpful health resources on the internet	4.0	0.6
4. I know how to use the internet to answer my questions about health	4.1	0.7
5. I know how to use the health information I find on the internet to help me	4.1	0.7
6. I have the skills I need to evaluate the health resources I find on the internet	4.0	0.8
7. I can tell high quality health resources from low quality health resources on the internet	4.1	0.8
8. I feel confident in using information from the internet to make health decisions	3.5	1.0

Table 2 shows that institution C had a significantly higher mean score compared to institutions A and B. The characteristics significantly associated with higher eHEALS scores were: male gender, longer time since enrolment in the course, full-time course, having close people who seek health information on the internet, mastering another language, and feeling good or very good about their current health status. According to the Dunn's test, compared to the first semester, students had a higher level of self-perceived DHL in the second

( $p=0.019$ ), third ( $p=0.007$ ), fourth ( $p<0.001$ ), fifth ( $p<0.001$ ), sixth ( $p<0.001$ ), seventh ( $p<0.001$ ), eighth ( $p<0.001$ ), ninth ( $p=0.002$ ) and tenth ( $p<0.001$ ) semesters. However, the tendency to increase the DHL did not keep growing over the semesters, as seen in table 2.

Table 3 shows that characteristics positively correlated to the level of DHL were age, considering the internet useful in helping making health decisions, and considering it useful to have access to health resources on the internet.

## Discussion

This is the first Brazilian study that found that sociodemographic data and academic characteristics of undergraduate nursing and medical students are related to their level of DHL. In the present study, the mean scores show that students feel they know where to find online health resources, how to use the information they find to answer their health questions, and how to differentiate high-quality and low-quality health resources online. However, they do not feel confident in using information from the internet to make health decisions.

Similar results were found in other studies. In Iran, more than half of university students in nursing and Midwifery, Management and Medical Informatics, Nutrition and Rehabilitation and Medicine do not feel confident in using information from the internet to make health decisions.<sup>(28)</sup> In Pakistan, where high levels of DHL were found, these were also related to low levels of self-confidence.<sup>(32,33)</sup>

In view of these findings, one of the critical targets to be considered when planning interventions to adjust DHL levels is self-confidence in the use of information, especially for females. Just as in our study, the female gender was associated with lower levels of self-perceived DHL in a study in Germany, where female university students had greater difficulties in searching for and evaluating COVID-19-related information online than male students.<sup>(34)</sup> Thus, interventions to improve female students'

**Table 2.** Relationship between the level of digital health literacy (eHEALS score) and sociodemographic and academic characteristics of nursing and medical students (n=346)

Variables	eHEALS score		
	Mean	SD	p-value
Gender			0.004*
Male	32.7	4.8	
Female	31.3	4.3	
Course			0.117*
Nursing	31.3	4.3	
Medicine	32	4.5	
Institution			<0.001#
A	30.7	4.8	
B	30.8	4.1	
C	33.4	3.9	
Course semestre			<0.001#
10	34.4	5.1	
9	34.2	4.5	
6	33.8	3.5	
4	33.0	3.7	
8	32.9	3.3	
11	32.6	5.9	
7	32.4	4.5	
5	31.1	4.6	
2	30.6	3.6	
3	30.2	4.5	
1	28.2	3.9	
Time			<0.001#
Daytime/full-time	32.4	4.3	
Morning	30.3	4.4	
Evening	29.8	3.9	
Number of financial dependants			0.271#
0	31.8	4.3	
1	31.4	5.6	
2	30.3	4	
3	32.4	4.6	
4	32.5	4.1	
5	32.1	3.5	
6	29.4	5	
Area of residence			0.140*
Urban	31.6	4.4	
Rural	29.2	4.1	
Relationship status			0.486*
Does not live with a partner	31.6	4.4	
Lives with partner	31.1	4.7	
Close people seek health information on the internet			0.003*
No	28.3	5.4	
Yes	31.8	4.3	
Mastery of a second language			<0.001*
No	30	4.2	
Yes	32.2	4.4	
Ethnicity			0.306#
Asian	32.6	5.2	
Caucasian	31.6	4.4	
Mixed	30.7	4.7	
African-American	32.2	3.8	
Religion			0.581#
Afro-Brazilian	31.2	4.3	
Buddhism	27.5	8.3	
Catholic	31.1	4.6	
Spiritist	32	2.9	

Continue...



Continuation.

Variables	eHEALS score		
	Mean	SD	p-value
Evangelical	31.8	3.7	0.235#
None	32.4	4.4	
Other	30.6	5.4	
Work situation			0.342#
Not economically active	31.7	4.4	
Economically active	31.2	4.4	
Family income			0.342#
Above R\$ 23,345	31.4	5.6	
up to R\$ 708	32.7	3.8	
R\$ 1,692 - R\$ 2,966	30.6	4.7	
R\$ 10,388 - R\$ 23,345	42.5	4.2	
R\$ 2,967 - R\$ 5,363	31.5	4.1	
R\$ 5,364 - R\$ 10,387	31.7	4.2	
R\$ 709 - R\$ 1,691	31.8	4.3	

\* Mann Whitney; # Kruskal Wallis

**Table 3.** Correlations between quantitative variables and levels of digital health literacy (eHEALS score) of nursing and medical students (n=346)

Variable/eHEALS score	Spearman's Rho	p-value
Age	0.253	<0.001
How useful do you feel the internet is in helping you in making decisions about your health?	0.371	<0.001
How important it is for you to be able to access health resources on the internet?	0.240	<0.001

confidence in using information to make health decisions are needed.

Our study showed a positive correlation between DHL levels and students' perception of the usefulness of the internet and its health content. A study conducted in Jordan corroborates these results, as it was found that perceptions about the importance and usefulness of the internet were related to the level of DHL.<sup>(17)</sup> This perception is potentially improved throughout the course, given the repeated demands for online search, judgment and application of information to solve clinical problems. As students progress throughout the course, their self-reported DHL also improves. In fact, other studies developed in Ethiopia, Ghana and Scotland have shown a relationship between time since enrollment in the course and higher levels of DHL.<sup>(35-37)</sup>

Our data are in line with this information, as they demonstrate that older students, those who have been longer in the course and those attending full-time courses have a higher DHL. Students at institution C – a public university – scored high-

er on the eHEALS compared to students at private institutions. This result is possibly due to the predominance of Nursing Course students in the sample, who are enrolled in a full-time course only at Institution C.

Compared to part-time courses, in full-time courses students remain in contact with the academic environment for a longer period, with a requirement to fulfill a greater workload in curricular and extracurricular activities, such as participation in extension projects and programs, scientific initiation activities, tutoring and academic leagues. Thus, students often find themselves in the role of health educators and promoters of scientific events, which requires searching for information online and judging its reliability, while supervised by professors.

This demonstrates that the curriculum can also contribute to the development of DHL. There is a need to create strategies at the university that collaborate with greater opportunities of access to digital platforms with high quality scientific content. Future healthcare professionals must develop adequate digital skills and use them to help their patients find reliable information.<sup>(12)</sup> Thus, a student is expected to migrate from a basic or interactive level of DHL to a critical level with even more advanced DHL cognitive skills tools in order to critically analyze information and control life events and health situations.<sup>(38)</sup>

Another challenge for faculty and students is balancing the equation professionalism versus personal privacy versus patient privacy in a virtual environment. Students often find it difficult to discern what is appropriate from what is inappropriate and feel an increasing need to maintain a professional profile online.<sup>(22)</sup> Thus, educators are expected not to assume that digital literacy attributed to digital-native students is highly developed and that they know how to distinguish where and when technology should be present (e.g., to allow students to research and collaborate online) and when it would be harmful (e.g., a source of distraction).<sup>(39)</sup> Therefore, the best strategies should be sought initially to diagnose and later to assess the level of DHL after interventions,<sup>(12,13)</sup> such as the use of eHEALS.

The three participating institutions do not have specific content on DHL. Similarly, in a study of 21,697 university students in the UK, only 17-28% received support or training to develop basic information technology skills, keep personal data secure, protect privacy in online spaces, and search, assess and apply information to problem solving.<sup>(40)</sup>

Strategies have been implemented in the academic curriculum to improve university students' DHL. In Australia, the College of Medicine, Nursing and Health Sciences, the College of Pharmacy and Pharmaceutical Sciences and the College of Information Technology at Monash University collaborated to make explicit the common digital health learning objectives required from all health students through the establishment of a curricular structure. Learning objectives include, for example, explaining how privacy is applied to digital health and its importance for healthcare professionals and explaining the opportunities, risks and challenges of using smartphones in the future.<sup>(41)</sup>

Our results are limited by data collection in only two regions of the country, which does not allow the generalization of results. Students with unstable connections may also have dropped out of participation or withdrew from participating. Also, if the Brazilian version of the eHEALS by Mialhe et al.<sup>(20)</sup> had been used, differences could have been found in the level of self-reported DHL, because items 1, 2, 3, 6 and 7 of the instrument were adapted differently by Barros<sup>(19)</sup> and Mialhe et al.<sup>(20)</sup> In these items, Mialhe et al.<sup>(20)</sup> used the expression "*recursos de saúde*" (health resources) and added the explanation that such resources refer both to the web pages and to health-related applications. Barros<sup>(19)</sup> in turn, used the expression "*conteúdos de saúde*" (health contents), emphasizing the information published online, as suggested by specialists during assessment of evidence of content validity. Although there is divergence in terms, future studies with similar populations can be performed to identify the limitations of versions of the eHEALS instrument used in Brazil.

In addition, social desirability - the student's desire to provide an expected and desired response in academia - may have impacted the outcome of

students' responses. Population-based studies with the assessment of the DHL level and related factors should be reproduced in order to support and direct curricular efforts in universities, engaging future health professionals in the dissemination of reliable information inside and outside the academic context, as well as in technology-assisted care.

## Conclusion

Among university nursing or medical students, being older, male, understanding the usefulness of the internet, having more time since enrollment in the course, studying full-time in a public institution, having close people who seek information about health online, mastering another language and having a positive feeling about health status were related to higher levels of DHL.

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