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Can a validated website help improve university students' e-health literacy?

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Parole chiave: Infodemia, fake news, educazione, e-health literacy

Abstract

Background. *The fight against fake news, mainly spread through Internet, is a major public health issue, even among undergraduate students. This study aims to evaluate the effectiveness of a website promoted by the Italian Federation of the Provincial Orders of the Medical Doctors as a first aid communication kit for health topics.*
Study design. *Pre-post study using a web-based survey, conducted in April-May 2019 on Medical students and October-November 2020 on Communication Sciences students at the University of Florence (Italy).*
Methods. *Undergraduate students of both schools were exposed to the use of the "dottoremaeveroche" website. Primary and secondary outcomes measures: the Italian-electronic Health Literacy Scale self-assessment tool was used to examine subjects' electronic Health literacy, and source quality. All responses were rated on a 5-point Likert scale. Changing in perception of abilities were examined using the Wilcoxon test.*
Results. *The 362 participants felt moderately confident in electronic Health Literacy, with an initial Italian-electronic Health Literacy Scale overall mean score of 3.6±0.7 for medical and 3.2±0.8 for communication students. Medical students had a good idea of how to find helpful sources (3.9±0.8) and communication students felt confident in recognizing their quality (3.5±1.0). In contrast, their confidence in using Web information to make health decisions was low (medical: 2.9±1.1; communication: 2.8±1.1). All items improved significantly after "dottoremaeveroche" use (p<.001), with the overall mean score of Italian-electronic Health Literacy Scale increasing to 4.3±0.6 for medical and 4.1±0.8 for communication students.*

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Conclusions. *Low electronic health literacy levels can affect public health efforts, as seen during the COVID-19 pandemic. The effectiveness of "dottoremaeveroche" among students showed the usefulness of online educational interventions that, if further implemented, could help combat the spread of infodemic.*

Introduction

As the Internet has become the primary source of health-related information, today's generation has access to a wide variety of medical topics, although access alone does not ensure that people are competent enough to extrapolate correct health beliefs. In 2000, the US Institute of Medicine proposed a definition of **health literacy** (HL) that encompasses an individual's ability to obtain, process, and understand basic health information and services in order to make appropriate health decisions (1). With the explosion of the Web resources, new aspects were gradually added and various definitions of HL were introduced. Norman et al. (2) proposed a definition of **electronic-health literacy** (e-HL) based on a model with six literacy factors (Lily model): traditional literacy, health literacy, information literacy, scientific literacy, media literacy, and computer literacy. Based on this model, e-HL was understood as the ability to seek, find, and ultimately understand and evaluate health information from electronic sources, and the ability to apply this knowledge to treat or solve health problems (2). Therefore, different and new competencies for obtaining e-health information have been called for, such as the ability to perform basic and advanced information searches using electronic devices, to distinguish different types of sources (e.g., scientific documents, journals, reputable medical sources), and to understand e-health terminologies (3). Several factors may influence e-HL: Functional Health Literacy, Need for Cognition, Irrational Health Beliefs, and Self-Efficacy (4). Functional Health Literacy, which consists of basic literacy and health information comprehension skills, is an essential skill for successfully using Internet resources to obtain health information (4). As Del Giudice et al. (5) showed in an Italian survey, Functional Health Literacy and e-HL appear to be positively correlated. Need for Cognition describes the different tendencies of people to exert cognitive effort (6) reflecting the individual ability to solve problems and the possibility of being influenced by strong personalities. Need for Cognition is also positively related to e-HL, especially Internet activities that involve cognitive components (7). Irrational Health Beliefs are most common in people with anxiety and hypochondria problems and consist of misinterpretation of health information and decision-making processes (8, 9). Self-Efficacy refers to self-perception in mobilizing motivation and cognitive resources, and in adapting actions to situational needs (10). Self-Efficacy is an important component in maintaining healthy behaviors and in important models of health (11). Norman et al. (2, 12) emphasized that a high percentage of the US and Canadian populations have basic literacy skills that are insufficient to participate in civil society, raising the question of whether the growing population lacks the resources to adequately understand medical topics, particularly from the Internet. Inadequate knowledge of disease issues and management can lead to poorer health status, with negative consequences for the doctor-patient relationship, the adherence

to prevention and screening programs, and medical treatment (13).

For these reasons, in February 2018, the Italian Federation of the Provincial Orders of Medical Doctors (FNOMCEO), developed an Internet resource, DMEVC (Italian acronym for "**D**ottore, **M**a **È** **V**ero **C**he", in English "Doctor, is it true that .."), to counteract the spread of fake medical news and allow the public to obtain accurate information about their health (14). This resource is a kind of first aid communication package for citizens looking for basic information on current health issues. All the information users can find are evidence-based and have been revised by specialists to be understandable to most of the population. One of the main goals of the DMEVC website is to provide a step-by-step educational flow consisting of formulating questions, thinking about the information resources provided, and discussing the topic. In particular, the "Conscious Web Browsing" section provides tutorials, interactive tests, and downloadable content to empower citizens to evaluate the quality of medical information. In this way, the process of taking note can be done in an active way, where the user plays a central role in distinguishing information. This digital tool has also been developed as a helpful tool for physicians involved in the daily care of patients to assist them in explaining and acknowledging healthy beliefs and behaviors (15).

The present study used a pre- and post-test design to investigate the improvement of Italian undergraduate students' e-health literacy before and after in-depth analysis of the DMEVC website.

Methods

A pre-post study was conducted at the University of Florence, Italy. University students in their first year of medical school and the Communication Theory program were invited to participate in the survey. Data were collected between April-May 2019 (Medical School) and October-November 2020 (Communication Sciences School), at the end of the lectures, using an online questionnaire. At the end of the lectures, participants were asked to assess their own digital competence in evaluating the quality of health-related information, paying attention to the relevance and reliability of Web sources, and referring to the time before and after learning about the DMEVC website and delving into the "conscious Web browsing" section and performing the related e-activity. Invitations to the survey were emailed by professors to students in the two courses; participation was possible for a few weeks after completion of the lectures. Participants were informed about the study and advised that their responses would be kept confidential and anonymous. Students' participation in the study and completion of the survey were considered their informed consent for the use of the data collected. Participation was voluntary, anonymous, and free of charge. No personal identifier was recorded, so it was not possible to trace responses back to the authors and thus formal ethical approval was not required according to the European regulation (EU-GDPR). All methods were performed in accordance with relevant guidelines and regulations.

Instrument

The eHEALS (eHealth Literacy Scale) is an 8-item self-assessment instrument developed by Norman et al. (12) to assess e-HL. After cross-cultural adaptation, this instrument was validated and used to study e-HL in Italy (IT-eHEALS) (16). The questionnaire is used to investigate respondents' competence in searching and evaluating e-health information in relation to their needs. In this survey, IT-eHEALS was used in addition to questions about the characteristics of source features and their quality. All responses were scored

on a 5-point Likert scale (1: strongly disagree; 5: strongly agree), with higher scores indicating best practices in the use of digital tools for health research. The usefulness of the DMEVC web resource was also examined, with particular attention paid to the "Conscious Web Browsing" section. Variables on sociodemographic characteristics such as age and gender, as well as Internet use for health-related purposes, were collected for each student.

Data analysis

Population characteristics are presented as frequency and percentage distributions or mean and standard deviation (SD) for categorical and continuous variables. Participants' responses to each item are presented as frequency, mean, and SD. The Wilcoxon Signed Rank Test was used to assess the relationship between the intervention and the change in responses for each item. All statistics were generated using STATA IC14 software.

Results

A total of 362 students participated in the survey, 329 from the Medical School and 33 from the Communication Theory program. The proportion of female respondents was 217 (59.9%) and the proportion of male respondents was 145 (40.1%). The mean age of the medical students was 20.6 ± 2.1 years, while the mean age of the communication students was 27.3 ± 4.3 years (Table 1).

Only 33 of the medical students (10.0%; female: 8.9%; male: 11.6%) were aware of the existence of the DMEVC website, which was mainly due to general Internet browsing, while ten communication students (30.3%; female: 34.6%; male: 14.3%) were aware of it (Table 1).

Referring to the initial assessment, the overall mean score of eHEALS for medical students was 3.6 (SD 0.7). Of the 329 participants, 159 (48.3%) had a score higher than the mean score of eHEALS. Participants felt somewhat confident about finding helpful health resources on the Internet (82.4% agreed or strongly agreed; n=271; mean 3.9, SD 0.8) and using the Internet to answer health questions (74.5% agreed or strongly agreed; n=245; mean 3.8, SD 0.9). On the other hand, they were less sure about the health resources available on the Internet, where to find helpful health resources, how to use the health information, and how to distinguish and evaluate high-quality health resources. The most critical item related to their perceived confidence in using information from the Internet to make health decisions (only 36.2% agreed or strongly agreed; n=119; mean of 2.9, SD 1.1). Regarding elements characterizing the quality of sources, participants agreed on the importance of authoritative sources

Table 1 - General characteristics of participants

School		Medical (n= 329)		Communication (n=33)	
Variable	Categories	N (%)	Mean (SD)	N (%)	Mean (SD)
Sex	Female	191 (58.1)		26 (78.8)	
	Male	138 (41.9)		7 (21.2)	
Age	Female		20.6 (1.9)		27.8 (4.6)
	Male		20.5 (2.3)		25.7 (2.4)
Previous awareness of DMEVC web source	Female	17 (8.9)		9 (34.6)	
	Male	16 (11.6)		1 (14.3)	

N: Number of observations; %: Percentage frequency; SD: standard deviation

(80.6% agreed or strongly agreed; n=265; mean of 4.1, SD 1.0), the topic (89.0% agreed or strongly agreed; n=293; mean of 4.3, SD 0.8), and the language used (81.4% agreed or strongly agreed; n=268; mean of 4.1, SD 0.8). Regarding the importance of the date of the last update, graphic elements, transparency of sources and bibliography, and sponsors/advertising, participants' opinions were almost divided (Table 2).

Communication students' eHEALS ratings were significantly lower. The initial eHEALS overall mean score was 3.2 (SD 0.8). The highest scoring item related to their perceived ability to distinguish low-quality from high-quality health resources (60.6% agreed or strongly agreed; n=20; mean of 3.5, SD 1.0), whereas they felt less confident about how and where to find or use health information on the Internet. The items with lower scores related to perceived ability to evaluate health information on the Internet (39.4% strongly agree or agree; n=13; mean of 2.9, SD 1.1) and confidence in using the information received (33.3% strongly agreed or agreed; n=11; mean of 2.8, SD 1.1). Regarding the elements characterizing the quality of sources, students appeared to be aware of the importance of authoritative sources and the topic (mean scores of 4.3 ± 1.1 and 4.4 ± 1.0, respectively), while the presence of sponsors/advertising was underestimated (mean score of 2.8 ± 1.4) (Table 2).

After a detailed analysis of the section "Conscious Web Browsing", 93.4% of students (n=338) felt more confident in recognizing and critically evaluating the quality of eHealth information. Mean scores for individual items improved after confirmation. Statistically significant differences in response ratings were found for both items from IT-eHEALS and items related to elements affecting source quality (Table 3, 4).

The overall mean score of IT-eHEALS increased to 4.3 (SD 0.6; p<.001) for medical students, whereas it increased to 4.1 (SD 0.8; p<.001) for communication students. Medical students positively or strongly agreed with each item of the IT-eHEALS, with 175 of them (53.2%) scoring above the mean. The items with lower scores related to perceived ability to evaluate health information on the Internet (79.6% agreed or strongly agreed; n=262; mean of 4.1, SD 0.1; p<.001) and confidence in using the Internet (72.0% agreed or strongly agreed; n=237; mean of 3.9, SD 1.2; p<.001). Of the 329 participants, 265 (80.6%) agreed or strongly agreed that authoritative sources were important, and 261 (79.3%) agreed or strongly agreed that the topic was important (mean of 4.7, SD 0.6; p<.001). In addition, the mean score related to transparency of sources, an aspect that not previously receive that much attention, increased to 4.7 (95.4% agreed or strongly agreed; n=314; p<.001). Participants' opinions also improved regarding the date of the last update, the language used, and the presence of sponsors/advertising (p<.001). The lowest rated item continued to be as such, regarding graphic elements (63.2% agree or strongly agree; n=208; mean of 3.8, SD 1.1) (Tables 3, 4).

Also among the Communication students, the items with the lowest scores were those related to their skills in evaluating health informations on the Internet (78.8% agreed or strongly agreed; n=26; mean of 3.9, SD 0.9; p<.001) and confidence in using the Internet (69.7% agreed or strongly agreed; n=23; mean of 3.6, SD 1.4; p=.002). The highest score was on the question about how to find and use health information (mean of 4.3; SD 0.9; p<.001). Scores on items related to elements of sources were all high, with maximum means of 4.8 ±0.6 and 4.8 ± 0.5, respectively, related to the importance of authoritative sources and topics. Participants' opinions about the presence of a sponsor/advertisement e lowest (63.6% agreed or strongly agreed; n=21; mean of 3.8, SD 1.3; p<.001) (Table 3, 4).

Table 2 - Students' response at the first evaluation.

School										
	Medical					Communication				
Items	Strongly disagree N (%)	Disagree N (%)	Undecided N (%)	Agree N (%)	Strongly agree N (%)	Strongly disagree N (%)	Disagree N (%)	Undecided N (%)	Agree N (%)	Strongly agree N (%)
eHEALS										
I1: I know how to find helpful health resources on the Internet	2 (0.6)	28 (8.5)	28 (8.5)	208 (63.2)	63 (19.2)	4 (12.1)	4 (12.1)	3 (9.1)	21 (63.6)	1 (3.0)
I2: I know how to use the Internet to answer my health questions	1 (0.3)	30 (9.1)	53 (16.1)	180 (54.7)	65 (19.8)	0	12 (36.4)	6 (18.2)	14 (42.4)	1 (3.0)
I3: I know what health resources are available on the Internet	7 (2.1)	44 (13.4)	76 (23.1)	152 (46.2)	50 (15.2)	4 (12.1)	4 (12.1)	6 (18.2)	16 (48.5)	3 (9.1)
I4: I know where to find helpful health resources on the Internet	7 (2.1)	39 (11.9)	73 (22.2)	163 (49.5)	47 (14.3)	4 (12.1)	7 (21.2)	7 (21.2)	12 (36.4)	3 (9.1)
I5: I know how to use the health information I find on the Internet to help me	5 (1.5)	46 (14.0)	60 (18.2)	148 (45.0)	70 (21.3)	2 (6.1)	6 (18.2)	8 (24.2)	15 (45.5)	2 (6.1)
I6: I have the skills I need to evaluate the health resources I find on the Internet	24 (7.3)	87 (26.4)	86 (26.1)	108 (32.8)	24 (7.3)	3 (9.2)	10 (30.3)	7 (21.2)	12 (36.4)	1 (3.0)
I7: I can tell high quality from low quality health resources on the Internet	6 (1.8)	41 (12.5)	62 (18.8)	147 (44.7)	73 (22.2)	0	8 (24.2)	5 (15.2)	15 (45.5)	5 (15.2)
I8: I feel confident in using information from the Internet to make health decisions	37 (11.3)	91 (27.7)	82 (24.9)	94 (28.6)	25 (7.6)	4 (12.1)	11 (33.3)	7 (21.2)	10 (30.3)	1 (3.0)
Source elements										
I1: Authoritative source	8 (2.4)	26 (7.9)	30 (9.1)	137 (41.6)	128 (38.9)	2 (6.1)	0	3 (9.1)	9 (27.3)	19 (57.6)
I2: Date of the last update	21 (6.4)	71 (21.6)	92 (28.0)	99 (30.1)	46 (14.0)	5 (15.2)	2 (6.1)	2 (6.1)	11 (33.3)	13 (39.4)
I3: Graphic elements	17 (5.2)	48 (14.6)	82 (24.9)	135 (41.0)	47 (14.3)	2 (6.1)	2 (6.1)	8 (24.2)	14 (42.4)	7 (21.2)
I4: Topic	2 (0.6)	10 (3.0)	24 (7.3)	137 (41.6)	156 (47.4)	2 (6.1)	0	1 (3.0)	11 (33.3)	19 (57.6)
I5: Language	2 (0.6)	18 (5.5)	41 (12.5)	161 (48.9)	107 (32.5)	2 (6.1)	0	3 (9.1)	14 (42.4)	14 (42.4)
I6: Transparency	17 (5.2)	57 (17.3)	84 (25.5)	95 (28.9)	76 (23.1)	3 (9.1)	3 (9.1)	6 (18.2)	6 (18.2)	15 (45.5)
I7: Sponsor/advertising	28 (8.5)	58 (17.6)	79 (24.0)	90 (27.4)	74 (22.5)	8 (24.2)	6 (18.2)	7 (21.2)	8 (24.2)	4 (12.1)

N: Number of observations; %: Percentage frequency

Table 3 - Students' response at the second evaluation

School	Medical					Communication				
Items	Strongly disagree N (%)	Disagree N (%)	Undeci-ded N (%)	Agree N (%)	Strongly agree N (%)	Strongly disagree N (%)	Disagree N (%)	Undeci-ded N (%)	Agree N (%)	Strongly agree N (%)
eHEALS										
I1: I know how to find helpful health resources on the Internet	2 (0.6)	4 (1.2)	8 (2.4)	143 (43.5)	172 (52.3)	0	2 (6.1)	2 (6.1)	12 (36.4)	17 (51.5)
I2: I know how to use the Internet to answer my health questions	1 (0.3)	4 (1.2)	12 (3.7)	135 (41.0)	177 (53.8)	0	2 (6.1)	3 (9.1)	11 (33.3)	17 (51.5)
I3: I know what health resources are available on the Internet	0	8 (2.4)	18 (5.5)	161 (48.9)	142 (43.2)	2 (6.1)	2 (6.4)	3 (9.1)	13 (39.4)	13 (39.4)
I4: I know where to find helpful health resources on the Internet	2 (0.6)	4 (1.2)	13 (4.0)	145 (44.1)	165 (50.2)	0	4 (12.1)	2 (6.1)	18 (54.6)	9 (27.3)
I5: I know how to use the health information I find on the Internet to help me	1 (0.3)	10 (3.0)	29 (8.8)	141 (42.9)	148 (45.0)	0	2 (6.1)	3 (9.1)	14 (42.4)	14 (42.4)
I6: I have the skills I need to evaluate the health resources I find on the Internet	4 (1.2)	23 (7.0)	40 (12.2)	131 (39.8)	131 (39.8)	0	4 (12.1)	3 (9.1)	18 (54.6)	8 (24.2)
I7: I can tell high quality from low quality health resources on the Internet	1 (0.3)	6 (1.8)	11 (3.3)	111 (33.7)	200 (60.8)	0	3 (9.1)	3 (9.1)	13 (39.4)	14 (42.4)
I8: I feel confident in using information from the Internet to make health decisions	10 (3.0)	27 (8.2)	55 (16.7)	132 (40.1)	105 (31.9)	4 (12.1)	4 (12.1)	2 (6.1)	14 (42.4)	9 (27.3)
Source elements										
I1: Authoritative source	3 (0.9)	3 (0.9)	5 (1.5)	53 (16.1)	265 (80.6)	0	0	3 (9.1)	3 (9.1)	27 (81.8)
I2: Date of the last update	2 (0.6)	4 (1.2)	13 (4.0)	87 (26.4)	223 (67.8)	0	0	2 (6.1)	4 (12.1)	27 (81.8)
I3: Graphic elements	11 (3.3)	25 (7.6)	85 (25.8)	109 (33.1)	99 (30.1)	2 (6.1)	0	8 (24.2)	7 (21.2)	16 (48.5)
I4: Topic	4 (1.2)	1 (0.3)	9 (2.7)	54 (16.4)	261 (79.3)	0	0	1 (3.0)	5 (15.2)	27 (81.8)
I5: Language	4 (1.2)	3 (0.9)	10 (3.0)	105 (31.9)	207 (62.9)	0	1 (3.0)	1 (3.0)	9 (27.3)	22 (66.7)
I6: Transparency	3 (0.9)	3 (0.9)	9 (2.7)	56 (17.0)	258 (78.4)	0	0	3 (9.1)	4 (12.1)	26 (78.8)
I7: Sponsor/advertising	20 (6.1)	9 (2.7)	24 (7.3)	77 (23.4)	199 (60.5)	4 (12.1)	0	8 (24.2)	9 (27.3)	12 (36.4)

N: Number of observations; %: Percentage frequency

Table 4 - Comparison of eHEALS and source elements before and after DMEVC acknowledgement

School	Medical			Communication		
Items	First evaluation Mean (SD)	Second evaluation Mean (SD)	p-value*	First evaluation Mean (SD)	Second evaluation Mean (SD)	p-value*
eHEALS						
I1:I know how to find helpful health resources on the Internet	3.9 (0.8)	4.5 (0.7)	<0.0001	3.3 (1.1)	4.3 (0.9)	<0.0001
I2: I know how to use the Internet to answer my health questions	3.8 (0.9)	4.5 (0.7)	<0.0001	3.1 (1.0)	4.3 (0.9)	<0.0001
I3: I know what health resources are available on the Internet	3.6 (1.0)	4.3 (0.7)	<0.0001	3.3 (1.2)	4.0 (1.2)	0.002
I4: I know where to find helpful health resources on the Internet	3.6 (1.0)	4.4 (0.7)	<0.0001	3.1 (1.2)	4.0 (0.9)	0.0002
I5: I know how to use the health information I find on the Internet to help me	3.7 (1.0)	4.3 (0.8)	<0.0001	3.3 (1.0)	4.2 (0.9)	<0.0001
I6: I have the skills I need to evaluate the health resources I find on the Internet	3.1 (1.1)	4.1 (0.1)	<0.0001	2.9 (1.1)	3.9 (0.9)	0.0001
I7: I can tell high quality from low quality health resources on the Internet	3.7 (1.0)	4.5 (0.7)	<0.0001	3.5 (1.0)	4.2 (0.9)	0.004
I8: I feel confident in using information from the Internet to make health decisions	2.9 (1.1)	3.9 (1.2)	<0.0001	2.8 (1.1)	3.6 (1.4)	0.002
Overall mean score	3.6 (0.7)	4.3 (0.6)	<0.0001	3.2 (0.8)	4.1 (0.8)	<0.0001
Source elements						
I1: Authoritative source	4.1 (1.0)	4.7 (0.6)	<0.0001	4.3 (1.1)	4.7 (0.6)	0.03
I2: Date of the last update	3.2 (1.1)	4.6 (0.7)	<0.0001	3.8 (1.4)	4.8 (0.6)	<0.0001
I3: Graphic elements	3.4 (1.1)	3.8 (1.1)	<0.0001	3.7 (1.1)	4.1 (1.1)	0.0009
I4: Topic	4.3 (0.8)	4.7 (0.6)	<0.0001	4.4 (1.0)	4.8 (0.5)	0.01
I5: Language	4.1 (0.8)	4.5 (0.7)	<0.0001	4.2 (1.0)	4.6 (0.7)	0.04
I6: Transparency	3.5 (1.2)	4.7 (0.7)	<0.0001	3.8 (1.4)	4.7 (0.6)	0.0002
I7: Sponsor/advertising	3.4 (1.2)	4.3 (1.1)	<0.0001	2.8 (1.4)	3.8 (1.3)	0.0004

SD: standard deviation; 1: strongly disagree; 5: strongly agree; *significant at $p<0.05$

Discussion and conclusions

This study was conducted to assess the perceived eHealth skills of undergraduate medical and communication students and to evaluate the effectiveness of a Web-based health resource, the DMEVC Web resource, in improving e-HL skills. IT-eHEALS and questions about the quality attributes of the resource were used as a self-assessment tool to evaluate eHealth skill improvement.

The eHEALS was first developed by Norman et al. (12) to measure users' knowledge, comfort, and perceived skills in searching and evaluating electronic health information in relation to their needs, and then translated into Italian and validated (16). It showed good results in assessing intervention outcomes over time (12) and great potential in testing electronic health literacy (17). Therefore, eHEALS could be considered a valid tool to support health promotion planning.

At baseline, this study found a mean eHEALS total score of 3.6 (SD 0.7) for medical students and 3.2 (SD 0.8) for Communication students. These scores are consistent with results of similar studies examining e-HL among college students (18-21) and suggest moderate confidence in using electronic devices for medical purposes. Medical students at baseline felt more confident in finding and using helpful health resources and in distinguishing low-quality from high-quality sources (item scores higher than the overall eHEALS mean score). Communication students' perceived better skills related to how to find and use medical information, what resources are available on the Internet, and how to distinguish the quality of sources, although these initial findings are partially consistent with other similar studies conducted with undergraduates. These seemed to know what resources were available and how to access them, their ability to find high-quality health resources was generally poor (18-22). Our findings may reflect students' high level of connection and interaction with technology in their daily lives and their attitudes toward surfing the Internet to search for general topics. The attention to the quality of sources could be explained by the specificity of the courses attended and the widely known problem of fake news and infodemic on medical topics. In contrast, in the current study, the items with the lowest scores for all participants were those related to health information assessment skills and confidence in its use. Many authors reached the same results in their studies (18, 19, 21) but related the lack of confidence in using the Internet for health-related decisions to the inability to assess the quality of sources. In the study population, these inconsistent results in assessment could be related to the lack of correct medical terminology for communication students and to the inexperience of first-year medical students. After learning about the DMEVC web resource and exploring the "Conscious Web Browsing" in depth, all scores improved for both medical and communication students, especially for the source quality themes. The authority of the sources and the way the topics were presented took on new meaning. However, the most critical issues remained the same, although the majority of participants felt less unsure about using health information.

The effectiveness of the DMEVC among students showed that appropriate interventions can improve confidence and e-HL skills. e-HL skills are important for medical students as future health professionals (23), to deal with health problems and educate and care for patients, but also for students and the general population to promote access to medical knowledge and encourage healthy behaviors. Extending online education to the general population could help combat the spread of infodemic and fake news.

Strengths and limitations

The current study examined only undergraduates, which limits our ability to generalize our findings. All participants attended first-year courses, but the two courses could not be compared due to large differences in sample size. The e-HL competence was assessed in a self-perspective way, which could lead to a possible misestimation and overestimation of the e-HL level, as suggested in the literature (3, 22). Further assessments using objective measures of digital health competency should be proposed to provide a comprehensive overview. Finally, we cannot rule out a possible recall or social desirability bias related to the fact that the survey, which covered skills referred to both before and after a specific lecture, were both acquired retrospectively.

In conclusion, undergraduate students and especially future health professionals need specific educational programs to improve their e-HL. The moderate level of e-HL among medical students may reflect the lower level in the general population and highlights that this is a critical public health problem. Accessible, effective, and validated sources such as the DMEVC could be adapted and strengthened specifically for the general population to improve critical thinking about health issues.

List of abbreviations

DMEVC: "dottoremaeveroche" website
eHEALS: The eHealth Literacy Scale
eHL: Electronic-Health Literacy
FNOMCeO: Italian Federation of Provincial Orders of Medical Doctors
HL: Health Literacy
IT-eHEALS: Italian version of the eHealth Literacy Scale
P: p-value
SD: Standard Deviation

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Authors' contributions: AC designed the study and collected the data. LA and VM performed the analyses. LB, VM and GV interpreted the final data and drafted the manuscript. MRG and MM developed the "aware internet surfing" section of the www.dottoremaeveroche.it website. AC, LA, MRG and MM revised intellectual contents. FA, MP supervised the conduction of the study. All authors read and approved the final version of the manuscript.

Riassunto

Un sito web validato può aiutare a migliorare la e-health literacy degli studenti universitari?

Premessa. La lotta alle fake news, diffuse principalmente attraverso Internet, è un problema di salute pubblica di primaria importanza, anche tra gli studenti universitari. Questo studio si propone di valutare l'efficacia di un sito web promosso dalla Federazione Nazionale degli Ordini Provinciali dei Medici, come kit di primo soccorso sui temi della salute.

Disegno dello studio. Studio pre-post attraverso utilizzo di un questionario online condotto tra aprile e maggio 2019 tra gli studenti di Medicina e tra ottobre e novembre 2020 tra gli studenti del corso di Teorie della Comunicazione presso l'Università di Firenze (Italia).

Metodi. Studenti universitari che frequentano le scuole di Medicina e di Scienze della Comunicazione sono stati esposti all'uso del sito web "dottoremaeveroche". Misure di risultato primarie e secondarie: strumento di autovalutazione Italian-electronic Health Literacy Scale per esaminare l'alfabetizzazione sanitaria elettronica dei soggetti e la qualità delle fonti. Tutte le risposte sono state valutate su una scala Likert a 5 punti. I cambiamenti nella percezione delle abilità sono stati esaminati utilizzando il test di Wilcoxon.

Risultati. I 362 partecipanti si sentivano moderatamente sicuri nell'alfabetizzazione sanitaria elettronica, con un punteggio medio iniziale sulla Italian-electronic Health Literacy Scale di 3,6±0,7 per gli studenti di Medicina e 3,2±0,8 per quelli di Teorie della Comunicazione. Gli studenti di Medicina avevano una buona conoscenza di come trovare fonti utili (3,9±0,8) e gli studenti di Teorie della Comunicazione si sentivano sicuri nel riconoscere la qualità di tali fonti (3,5±1,0). Al contrario, la fiducia nell'uso delle informazioni reperite sul Web per prendere decisioni sulla salute era bassa (Medicina:

2,9±1,1; Teorie della Comunicazione: 2,8±1,1). Tutti gli item sono migliorati significativamente dopo l'uso del sito "dottoremaeveroche" (p<.001), con il punteggio medio complessivo della Italian-electronic Health Literacy Scale aumentato a 4,3±0,6 per gli studenti di medicina e a 4,1±0,8 per quelli di comunicazione.

Conclusioni. Bassi livelli di alfabetizzazione sanitaria elettronica possono influire sugli sforzi di salute pubblica, come si è visto durante la pandemia di COVID-19. L'efficacia del sito "dottoremaeveroche" tra gli studenti ha dimostrato l'utilità degli interventi educativi online che, se ulteriormente implementati, potrebbero aiutare a combattere la diffusione dell'infodemia.

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