

# Evaluation of e-health literacy with the DMVEC.it website in undergraduate student: a pre-test and post-test study

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**Research**

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## Abstract

## Background

The struggle against fake medical news, especially spread by web sources, is a main issue in public health. Even among college students, there is a lack of eHealth literacy (eHL) skills. The Italian Medical Doctors Federation (FNOMCeO) promoted a website as a first-aid communication kit for notions in health hot-topics named “dottoremaeveroche” (DMVEC). This study aims to evaluate its effectiveness in improving eHL.

## Methods

Between April 2019 and October 2020, college students attending the first year of medical and communication theory course at the University of Florence (Italy) joined a web-based survey before and after accessing the DMVEC website. The 8-item self-assessment IT-eHEALS tool was used to examine subject's eHL, in addition to questions on source's features and its quality. All responses were rated on a 5-points Likert scale. Changing of abilities perception was assessed using Wilcoxon test.

## Results

362 students joined the survey, 329 medical and 33 communication ones. Participants felt moderately confident in eHL, with an initial IT-eHEALS overall mean score of  $3.6 \pm 0.7$  for medical students and of  $3.2 \pm 0.8$  for communication students. Medical students had a good perception on how to find helpful health sources (mean score of  $3.9 \pm 0.8$ ) and communication students felt sure in discerning sources quality (mean score of  $3.5 \pm 1.0$ ). Instead, their confidence in using web information to make health decisions was low (medical students: mean score of  $2.9 \pm 1.1$ ; communication students: mean score of  $2.8 \pm 1.1$ ). All items improved after the use of DMVEC, with overall mean score of IT-eHEALS increasing to  $4.3 \pm 0.6$  ( $p < 0.01$ ) for medical students and to  $4.1 \pm 0.8$  ( $p < 0.01$ ) for communication students. Also the items with the lowest scores improved, even if remained the most critical (medical students: mean score of  $3.9 \pm 1.2$ ; communication students: mean score of  $3.6 \pm 1.4$ ;  $p < 0.01$ ).

## Conclusions

Low levels of eHL can damage public health efforts, as seen during COVID19 pandemic. DMVEC effectiveness in college students demonstrated the benefit of online educational interventions that, with further implementation, could help in tackling infodemic and fake news spreading.

## Contributions To The Literature

- Research has shown the complexities of electronic-Health Literacy (eHL) skills and the high impact of the web in people' health consciousness, highlighting this as a critical issue in public health
- Our findings revealed that college students and even medical students could have difficulties in discerning proper medical information from the web and the evaluation of eHL could represent a first step towards educational programs
- Validated web-based instruments, such as DMVEC website, can improve eHL skills and provide medical acknowledgement for college students in an easy way

## Background

Since the Internet has become the major source of Health-related information, the current generation has access to a multitude of medical topics, although access alone does not ensure that people are skilled enough to extrapolate proper health notions. The US Institute of Medicine in 2000 proposed a definition of Health Literacy (HL) which include the capacity of individuals to obtain, process, and understand basic health information and services needed to make appropriate decisions for their health<sup>1</sup>. Gradually, with the explosion of web sources, new aspects emerged and different definitions of HL were introduced. Norman et al.<sup>2</sup> suggested a definition of electronic-Health Literacy (e-HL), based on a six literacy factors model (Lily model): traditional literacy, health literacy, information literacy, scientific literacy, media literacy, and computer literacy. Resulting from this model, e-HL was intended as the ability to seek, find, and finally understand and appraise health information from electronic sources and the capability to apply this knowledge to addressing or solving a health problem<sup>2</sup>. Therefore, various and new competencies were required to obtain e-Health information, such as abilities in conducting basic and advanced information searches with electronic devices, discriminating types of sources (e.g., scholarly documents, periodicals, respectable medical sources) and understanding e-Health terminologies<sup>3</sup>. Several factors can influence people's e-HL: Functional Health Literacy, Need for Cognition, Irrational Health Beliefs and Self-Efficacy<sup>4</sup>. Functional Health Literacy, which consists of basic literacy and numeracy skills useful to comprehend health information, is an essential skill for a successful application of web sources to obtain health information<sup>4</sup>. It seems that Functional Health Literacy and e-HL are positively correlated, as shown by Del Giudice et al.<sup>5</sup> in an Italian survey. Need for Cognition describes a different tendencies of people in making effortful cognitive activity<sup>6</sup>,

reflecting on individual capability of problem solving and chance of being influenced by powerful personalities. Need for Cognition positively relates to e-HL too, especially for internet activity that entails cognitive components<sup>7</sup>. Irrational Health Beliefs is bounded particularly to people with anxiety and hypochondriasis problems and consists in misinterpretation of health information and decision-making process<sup>8,9</sup>. Self-Efficacy refers to the self-perception in mobilizing the motivation, cognitive resources and in modifying actions to face situational needs<sup>10</sup>. Self-Efficacy is an important component in maintaining healthy behaviors and in major health models<sup>11</sup>. Norman et al.<sup>2,12</sup> underlined that high rates of the US and Canadian population have basic Literacy skills below the need to participate in civil society, raising the question that growing population does not have the means to adequately understand medical concerns, especially from the web. Unqualified knowledge of disease aspects and management can lead to poorer health status, with negative consequences on doctor-patient relationships, adherence to prevention, screening programs and medical treatment<sup>13</sup>.

For these reasons, since February 2018, the Italian National Federation of Medical Doctors (FNOMCeO) developed a Web source to counter the spread of fake medical news and as a means for the general public to obtain proper health acknowledgement: [www.dottoremaeveroche.it](http://www.dottoremaeveroche.it)<sup>14</sup>. This source represents a sort of first-aid communication kit for citizens who are looking for basic notions in health hot-topics. Every information that the user can find is evidence-based and has been revised by health specialists to be comprehensible to the largest part of the population. One of the main purposes of “*dottoremaeveroche*” (DMVEC) website is to give a step by step teach-back flow made of questions formulation, time to think over provided informative instruments, discussion on the topic. Specifically, the “aware internet surfing” section provides tutorials, interactive tests and downloadable contents, in order to improve citizens' e-HL and make them acquire skills and competences to evaluate quality of medical information. In this way, the process of acknowledgement can be performed in an active way, in which the user plays a central role in discerning information. This digital instrument was also born to be a helpful tool for doctors daily involved in the care of patients to support them in explanation and acknowledgment of healthy notions and behaviours<sup>15</sup>.

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

## Methods

A pre-post study was conducted at the University of Florence, Italy. Data were collected using an online questionnaire from April 2019 and October 2020. University students attending the first year of medical course and communication theory course were invited to join the survey. Each participant was asked to evaluate their own digital competence in evaluating quality of health related information, paying attention to relevance and reliability of web sources, before and after the acknowledgement of DMVEC website and the in-depth examination of “aware internet surfing” section. The collection of data begun with a message that was sent to all the students that invited them to compile the e-Heals survey. Participants received information about the study specifying that their answers would be kept confidential and anonymous. The final test was administered to students after the explanation of the aim and the structure of the DMVEC website and the “aware internet surfing” section and the completion of the related e-tivity.

## Instrument

The eHEALS is an 8-item self-assessment tool developed by Norman et al.<sup>12</sup> to evaluate e-Health Literacy. After cross-cultural adaptation, this tool was validated and used to investigate e-HL in Italy (IT-eHEALS)<sup>16</sup>. The questionnaire examines the subject's expertise in searching and evaluating eHealth related information in relation to their needs. In this survey, IT-eHEALS was used in addition to questions regarding source's features and its quality. All responses were rated on a 5 points Likert scale (1: strongly disagree; 5: strongly agree), with higher scores indicating best practice in using digital instruments for health research. Usefulness of DMVEC web source was also investigated, paying particular attention to “aware internet surfing” section. Variables regarding to sociodemographic characteristics, as age and sex, and Internet use for health-related purposes were collected for each student.

## Data analysis

Characteristics of the population were presented as frequency and percentage distribution or mean and standard deviation (SD), for categorical and continuous variables, respectively. Participants' responses to each item were displayed using frequency, mean, median and SD. Wilcoxon Signed Rank test was used to assess the relationship between intervention and changing in answers for each item ( $p < 0.05$ ). All statistics were conducted using STATA IC14 software.

## Results

A total of 362 students joined the survey, 329 of them belonging to medical school and 33 to communication theory school. Female respondents were 217 (59.9%) and male respondents were 145 (40.1%). The mean age of medical students was  $20.6 \pm 2.1$  years while the mean age of communication students was  $27.3 \pm 4.3$  years (Table 1) [see Additional file 1, page 1]. Only 26 of medical students (7.9%; Female: 8.9%; Male:

11.6%) were aware of the existence of DMVEC website, mostly due to general surfing of the web, while 10 communication students (30.3%; Female: 34.6%; Male: 14.3%) were aware of it (Table 1) [see Additional file 1, page 1].

Regarding first evaluation, the initial overall mean score of eHEALS for medical students was 3.6 (SD 0.7). Of the 329 participants, 159 (48.3%) had scores higher than the mean score of eHEALS. Participants felt moderately confident in how to find helpful health resources on the Internet (82.4% agree or strongly agree;  $n = 271$ ; mean score of 3.9, SD 0.8) and how to use the Internet to answer health questions (74.5% agree or strongly agree;  $n = 245$ ; mean score of 3.8, SD 0.9). On the other hand, they felt quite less sure concerning what health resources are available on the Internet, where to find helpful health resources, how to use the health information and in the ability in discerning and evaluating low quality to high quality health resources. The most critical item regarded their perceived confidence in using information from the Internet to make health decisions (only 36.2% agree or strongly agree;  $n = 119$ ; mean score of 2.9, SD 1.1). In terms of elements that characterize the quality of sources, participants accorded with the importance of authoritative sources (80.6% agree or strongly agree;  $n = 265$ ; mean score of 4.1, SD 1.0), subject matter (89.0% agree or strongly agree;  $n = 293$ ; mean score of 4.3, SD 0.8) and language used (81.4% agree or strongly agree;  $n = 268$ ; mean score of 4.1, SD 0.8). Participant's opinion was almost split about the significance of date of last update, graphic elements, transparency of sources and bibliography and sponsor/advertisement (Table 2) [see Additional file 1, page 1–2].

eHEALS scores of communication students were quite lower. The initial overall mean score of eHEALS was 3.2 (SD 0.8). The item with higher score regarded their perceived ability in distinguishing low quality from high quality health resources (60.6% agree or strongly agree;  $n = 20$ ; mean score of 3.5, SD 1.0), while they felt less confident in how and where to find or use health information on the Internet. The items with lower scores were the ones concerning the perceived abilities in evaluating health information on the internet (39.4% agree or strongly agree;  $n = 13$ ; mean score of 2.9, SD 1.1) and the self-confidence in the use of the information obtained (33.3% agree or strongly agree;  $n = 11$ ; mean score of 2.8, SD 1.1). In terms of elements that characterize the quality of sources, students appeared conscious about the importance of authoritative sources and subject matter (mean scores of  $4.3 \pm 1.1$  and  $4.4 \pm 1.0$  respectively), while the presence of sponsor/advertisement was underestimated (mean score of  $2.8 \pm 1.4$ ) (Table 2) [see Additional file 1, page 1–2].

After in-depth analysis of the “aware internet surfing” section, 93.4% of students ( $n = 338$ ) felt more confident in recognizing and critically evaluating the quality of eHealth information. Mean scores of each item improved after the acknowledgement. Statistical significant differences in rate responses were found both in items of IT-eHEALS and in items related to elements that influence quality of sources (Table 3) [see Additional file 1, page 2–3].

The overall mean score of IT-eHEALS for medical students increased to 4.3 (SD 0.6;  $p < 0.001$ ), while for communication students increased to 4.1 (SD 0.8;  $p < 0.001$ ). Medical students positively agreed or strongly agreed to each item of the IT-eHEALS, with higher scores than the mean score for 175 of them (53.2%). The items with lower scores were the ones regarding the perceived abilities in evaluating health information on the internet (79.6% agree or strongly agree;  $n = 262$ ; mean score of 4.1, SD 0.1;  $p < 0.001$ ) and the self-confidence in their use (72.0% agree or strongly agree;  $n = 237$ ; mean score of 3.9, SD 1.2;  $p < 0.001$ ). Of the 329 participants, even 265 (80.6%) strongly agreed concerning the importance of authoritative sources and 261 (79.3%) strongly agreed with the significance of subject matter (mean scores of 4.7, SD 0.6;  $p < 0.001$ ). In addition, the mean score related to transparency of sources, an aspect not well considered before, increased to 4.7 (95.4% agree or strongly agree;  $n = 314$ ;  $p < 0.001$ ). Participant's opinion improved in the consideration of date of last update, language used and presence of sponsor/advertisement too ( $p < 0.001$ ). The item with the worst score remained the one concerning graphic elements (63.2% agree or strongly agree;  $n = 208$ ; mean score of 3.8, SD 1.1) (Table 4) [see Additional file 1, page 4].

Also for communication students, the items with lower scores were the ones regarding their skills in evaluating health information on the internet (78.8% agree or strongly agree;  $n = 26$ ; mean score of 3.9, SD 0.9;  $p < 0.001$ ) and the self-confidence in their use (69.7% agree or strongly agree;  $n = 23$ ; mean score of 3.6, SD 1.4;  $p = 0.002$ ). The item with highest score concerned how to find and to use health information (mean score of 4.3; SD 0.9;  $p < 0.001$ ). Scores of items related to sources elements were all high, with a maximum mean score concerning the importance of authoritative sources and subject matter of  $4.8 \pm 0.6$  and  $4.8 \pm 0.5$  respectively. Participant's opinion about the presence of sponsor/advertisement remained the lowest (63.6% agree or strongly agree;  $n = 21$ ; mean score of 3.8, SD 1.3;  $p < 0.001$ ) (Table 4) [see Additional file 1, page 4].

## Discussion

This study was conducted to assess the perceived eHealth ability of non-degree medical and communication students and to evaluate the efficacy of a web based health resource, DMVEC web source, in improving eHL skills. IT-eHEALS and questions regarding the source's quality features were used as a self-assessment tool in order to evaluate improvement in eHL abilities.

The eHEALS was first developed by Norman et al.<sup>12</sup> to measure users' knowledge, comfort and perceived skills in finding and evaluating e-Health information in relation to their needs, and then translated and validated in Italian language<sup>16</sup>. It showed good results in evaluating intervention outcomes over time<sup>12</sup> and a great potential in electronic health literacy screening<sup>17</sup>. For this reason, eHEALS could be considered a valid tool in order to support health promotion planning.

At baseline this study revealed an overall mean score of eHEALS of 3.6 (SD 0.7) for medical students and of 3.2 (SD 0.8) for communication students. These scores are consistent with results obtained by similar studies that analyzed e-HL among college students<sup>18, 19, 20, 21</sup> and pointed out a moderate confidence in the use electronic devices for medical purposes. Medical students at the beginning felt more confident in how to find and use helpful health resources and how to discern low quality from high quality sources (items scores higher than the overall mean score of eHEALS). Communication students' perceived abilities with higher scores concerned how to find and use medical information, what resources are available on the Internet and how to discriminate sources' quality too. These initial findings partially agreed with other similar studies conducted on college students who seemed aware of available resources and how to reach them, but their abilities in finding good quality health resources were generally poor<sup>18, 19, 20, 21, 22</sup>. Our findings could reflect the high level of students' connection and interaction with technology in their everyday life and their attitude towards web surfing to investigate general topics. Attention to the source quality could be explained by the peculiarity of the courses attended and the widely well-known issue of fake news and infodemic on medical topics. Instead, in the current study, the items with the lowest scores for all participants were the ones concerning the abilities in evaluating health information and the self-confidence in its use. Many authors<sup>21, 18, 19</sup> found the same results in their studies, but they correlated the lack of confidence in using the Internet in health-related decisions to the inability in judging the sources' quality. In the study population, these contradictory results in the evaluation process could be linked to the lack of proper medical terminology for communication students and to the inexperience for medical students attending only their first year. After the acknowledgement of DMVEC web source and the in-depth examination of "aware internet surfing" section, all scores improved for both medical and communication students, especially on the topics about sources' elements of quality. The authority of sources and the way of subjects presentation assumed new relevance. Despite this, the most critical items remained the same, even if the majority of participants felt less insecure to apply health information.

DMEVC effectiveness in undergraduate students demonstrated that appropriate intervention could improve self-confidence and e-HL skills. E-HL skills are essential both for medical students as health professionals, in order to manage health related problems and to educate and take care of patients, and for undergraduate students, as well as for general population, to encourage access to medical knowledge and promote healthy behaviors. The scaling up to the general population of online educational interventions could help in tackling infodemic and fake news spreading.

#### *Limitations of the study*

The current study examined only undergraduate students, which limits the possibility of generalizing our findings to the general population. All participants attended the first years of university, but the degree courses could not be compared because of the large difference in samples size. The e-HL competence was evaluated in a self-perspective way, with a possible misjudgment and overvaluation of the e-HL level, as yet suggested in literature<sup>3, 22</sup>. Further assessment via objective measures of digital health skills should be proposed for a comprehensive overview.

## **Conclusions**

Undergraduate students, and future health professionals in particular, need specific educational programs to improve their e-HL. Moderate levels of e-HL among medical students could reflect lower levels in general population, highlighting this as a critical issue in public health. Accessible, effective and validated sources, as DMVEC, could be adapted and empowered specifically targeting general population in order to improve critical thinking on health topic.

## **Abbreviations**

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

# Declarations

## Ethics approval and consent to participate

- Research involving human participants. Procedures performed in this study involving human participants were in accordance with the ethical standards, 1964 Helsinki declaration and its later amendments or comparable ethical standards.
- Informed consent. Not applicable.

## Consent for publication

Not applicable.

## Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

## Competing interests

Disclosure of potential conflicts of interests. The authors declare that they have no conflict of interest.

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## Authors' contribution statement

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

## Acknowledgements

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## Tables

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

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

<b>Table 2:</b> Students' response at the first evaluation.										
<b>School</b>	<b>Medical</b>					<b>Communication</b>				
<b>Items</b>	<b>Strongly disagree N (%)</b>	<b>Disagree N (%)</b>	<b>Undecided N (%)</b>	<b>Agree N (%)</b>	<b>Strongly agree N (%)</b>	<b>Strongly disagree N (%)</b>	<b>Disagree N (%)</b>	<b>Undecided N (%)</b>	<b>Agree N (%)</b>	<b>Strongly agree N (%)</b>
<b>eHEALS</b>										
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)
<b>Source elements</b>										
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 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: Subject matter	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/advertisement	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)
<i>N: Number of observations; %: Percentage frequency</i>										

<b>Table 3:</b> Students' response at the second evaluation										
<b>School</b>	<b>Medical</b>					<b>Communication</b>				
<b>Items</b>	<b>Strongly disagree N (%)</b>	<b>Disagree N (%)</b>	<b>Undecided N (%)</b>	<b>Agree N (%)</b>	<b>Strongly agree N (%)</b>	<b>Strongly disagree N (%)</b>	<b>Disagree N (%)</b>	<b>Undecided N (%)</b>	<b>Agree N (%)</b>	<b>Strongly agree N (%)</b>
<b>eHEALS</b>										
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)
<b>Source elements</b>										
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 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: Subject matter	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/advertisement	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)
<i>N: Number of observations; %: Percentage frequency</i>										

<b>Table 4:</b> Comparison of eHEALS e source elements before and after DMVEC acknowledgement						
<b>School</b>	<b>Medical</b>			<b>Communication</b>		
<b>Items</b>	<b>First evaluation</b>	<b>Second evaluation</b>	<b>p-value*</b>	<b>First evaluation</b>	<b>Second evaluation</b>	<b>p-value*</b>
	<b>Mean (SD)</b>	<b>Mean (SD)</b>		<b>Mean (SD)</b>	<b>Mean (SD)</b>	
<b>eHEALS</b>						
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
<b>Source elements</b>						
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 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: Subject matter	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/advertisement	3.4 (1.2)	4.3 (1.1)	<0.0001	2.8 (1.4)	3.8 (1.3)	0.0004
<i>SD: standard deviation; 1: strongly disagree; 5:strongly agree; *significant at p&lt;0.05</i>						

## Supplementary Files

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- [Additionalfile2.docx](#)