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Exploring the role of health literacy in the evaluation of online health information: Insights from a mixed-methods study

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ABSTRACT

Objective: To gain new insights into the relationship between health literacy and evaluation of online health information.
Methods: Using a mixed-methods approach, forty-four semi-structured interviews were conducted followed by a short questionnaire on health literacy and eHealth literacy. Qualitative and quantitative data were merged to explore differences and similarities among respondents with different health literacy levels.
Results: Thematic analysis showed that most respondents did not question the quality of online health information and relied on evaluation criteria not recognized by existing web quality guidelines. Individuals with low health literacy, despite presenting higher eHealth literacy scores, appeared to use less established criteria and to rely more heavily on non-established ones compared to those with high health literacy.
Conclusion: Disparities in evaluation ability among people with different health literacy might be related to differences in awareness of the issue and to the use of different evaluation criteria. Future research should quantitatively investigate the interplay between health literacy, use of established and non-established criteria, and ability to evaluate online health information.
Practice implications: Communication and patient education efforts should aim to raise awareness on online health information quality and to promote use of established evaluation criteria, especially among low health literate citizens.

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1. Introduction

Almost two out of three Internet users have already looked for online health information (OHI), making the Internet one of the main sources of health information [1,2]. Often OHI-seekers do not follow up their search with a physician, putting themselves at risk of acting upon wrong information [1]. The risk of encountering wrong information online is "a function of both the proportion of inadequate information on the Web and the inability of the individual to filter inadequate sites" [3]. Several initiatives to improve OHI quality have been proposed, including the introduction of certificates designating quality websites [4]. Yet, studies on health websites have highlighted high variance in information quality [5]. The individuals' ability to critically evaluate OHI becomes thus of crucial importance and lacking this specific skill could lead to important health disparities [6].

People's ability to *evaluate* health information, with the ability to *search*,*understand*, and *apply* it, is routinely included among the skills needed to be considered health literate [7,8]. Low health literacy has been shown to be associated with less frequent *searches* for health information, to a poorer ability to *understand* information, and to a poorer ability to *apply* health-related instructions [9–12]. Surprisingly, as highlighted by a recent review, the relationship between health literacy and ability to *evaluate* OHI has only rarely been studied [13]. Nevertheless, the results of the review suggest that low health literacy might have a negative impact on OHI evaluation.

People's interaction with OHI has been object of several studies, which have shown for instance that people often do not question OHI quality and use incorrect criteria to evaluate it [3,14–19]. To the best of our knowledge, however, no studies have conducted a comprehensive in-depth investigation into how individuals evaluate OHI quality. At the same time, an increasing number of empirical studies have investigated how health literacy impacts

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OHI-seeking [20–22]. Although an in-depth exploration of OHI evaluation in underserved populations was called for more than a decade ago [6,23], differences among individuals with low and high health literacy in this specific domain have hardly been investigated so far [13].

Our aim is to contribute to the understanding of this phenomenon through a detailed examination of how people with different health literacy levels evaluate OHI quality, with particular emphasis on differences in awareness of the issue of OHI quality and in knowledge and use of evaluation criteria. Besides providing us with new insights on the topic from the users' perspective, this study will allow to outline a first explanatory theory of the relationship between the constructs.

2. Material and methods

2.1. Study design

A mixed-methods approach was chosen [24]. In-depth data were collected via semi-structured interviews on awareness of OHI quality and on knowledge and use of evaluation criteria. A qualitative approach was particularly suited to the largely unexplored nature of the topic [25,26]. Quantitative data were collected via standardized questionnaires about health literacy and perceived ability to perform OHI-related tasks. This allowed us to distinguish individuals with low and high health literacy and to link the participants' in-depth description of their behavior to a quantitative self-assessment of their skills.

The study was approved by the Ticino (Switzerland) Ethical Committee (Ref. CE2773). All participants gave their informed consent before the interview. Confidentiality was ensured and identifying information was removed during the transcription process.

2.2. Study participants and recruitment

Interviews were conducted in a purposive sample of Italian-speaking adults with previous experience with OHI. Recruitment took place through online ads posted via social network sites as well as through flyers distributed in person in local discount supermarkets, adult literacy centers, and job centers. Using both online and offline recruitment strategies was functional to minimize self-selection bias. The recruitment strategy was purposively chosen to maximize diversity in terms of socio-economical background and to ensure the inclusion in the sample of an adequate number of individuals with low health literacy [27].

2.3. Data collection

Data were collected in spring 2014 in Italian-speaking Switzerland and in Northern Italy. Interviews were held in locations chosen by the participants and lasted between 30 and 60 min. The interviews were conducted by one of two researchers with experience in qualitative research. The first five interviews were conducted jointly in order to maximize consistency in the interview process.

The qualitative semi-structured interview consisted of open-ended questions and probes on a pre-defined list of topics (Appendix A). First, participants were asked to describe their last OHI search. Specifically, they were asked about the motivations for choosing the Internet, the problems encountered, and how they used the information obtained. To understand whether OHI quality was a spontaneous concern, this aspect was purposively addressed only in the second part of the interview. Participants were then asked about their overall perception of OHI quality and were explicitly prompted to elaborate on the criteria they used to evaluate it.

After the in-depth interview, respondents completed the Newest Vital Sign (NVS) and the eHealth Literacy Scale (eHEALS). The NVS (range 0–6) is the sum score of six correct/wrong questions (Cronbach's $\alpha = 0.742$) about a nutrition label for an ice cream for diabetics [28]. NVS scores were used to assign the respondents to the low or high health literacy group (based on a median-split, see e.g., [29]). The eHEALS (range 1–5) is the mean score of eight questions (Cronbach's $\alpha = 0.852$) in which participants have to self-rate their ability to accomplish several tasks related to OHI seeking on a 5-point Likert scale [30].

Data collection ended when additional interviews did not add new themes, thus indicating data saturation [31]. Data saturation was already reached after 10 interviews for some themes (e.g., outcomes of the search), while it occurred only after 39 interviews for use of evaluation criteria.

Table 1
Participants' characteristics.

	Low HL ($n = 23$)	High HL ($n = 21$)	Total sample ($n = 44$)
Gender *n* (%)			
Male	10 (43.5)	14 (66.7)	24 (54.5)
Female	13 (56.5)	7 (33.3)	20 (45.5)
Age			
Mean (SD)	38.17 (13.371)	36.81 (8.066)	37.52 (11.055)
Educational level *n* (%)*			
Compulsory education only	5 (21.7)	1 (4.8)	6 (13.6)
Vocational training	11 (47.8)	6 (28.6)	17 (38.6)
High school or professional school	0 (0.0)	2 (9.5)	2 (4.5)
Higher professional education	3 (13.0)	1 (4.8)	4 (9.1)
College or more	4 (17.4)	11 (52.4)	15 (34.1)
Health literacy [NVS]***			
Mean (SD)	2.57 (1.409)	5.57 (0.507)	4.00 (1.855)
eHealth literacy [eHEALS]**			
Mean (SD)	3.67 (0.564)	3.07 (0.796)	3.40 (0.734)

Difference between the Low and High HL groups: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Box 1. Quotes from qualitative interviews by theme.

Quote #	**Main theme** Sub-theme	Participant's quote
Reasons for searching		
Q1	Self-diagnosis	"I searched on the Internet because I'm a little bit afraid of doctors, so I always try to find alternative solutions first" (Male, 32, high HL)
Q2	Complement GP visit	"It was right before undergoing a surgical procedure to get rid of a cyst. I wanted to know what was going to happen during the surgery and what were the risks" (Male, 33, low HL)
Q3	Prepare GP visit	"I always search online before seeing my GP, so I can use the right terms and I can be more confident when speaking to him" (Male, 29, high HL)
Q4	Curiosity	"I was looking for general information on childhood vaccinations. You know, my daughter didn't receive any, so I wanted to understand what different physicians think about this" (Male, 35, high HL)
Q5	Information about doctor or hospital	"I'm going to have my knee replaced with a prosthesis at [name of a local hospital] in a few weeks. I looked it up to see if this is actually the best hospital [for this specific surgery] . . . And also to check whether they have a chapel or they offer some sort of spiritual support" (Female, 50, low HL)
Q6	Impossibility to visit GP	"I was looking for something to help me with a bad toothache. I searched online because my dentist was out of town and I didn't want to go to another one" (Male, 61, low HL)
Q7	Challenge diagnosis	"Following 3 months of amenorrhea, I was diagnosed with micropolycystic ovary syndrome. As I did not want to accept this diagnosis, I searched online for possible different explanations" (Female, 24, high HL)
Access point		
Q8	Known website	"I usually refer to the official gluten intolerance websites. Or to a website I know, which is written by an Italian cook who cooks gluten-free" (Female, 36, high HL)
Spontaneous quality concern		
Q9	–	"[I am] quite satisfied. I don't take what I find on the Internet as the gospel truth, but it gave me a sense of it" (Male, 36, low HL)
Online health information quality evaluation		
Q10	Varying quality	"It really depends on the website . . . In general I think it is possible to find quite reliable information" (Female, 22, low HL)
Q11	Overall low quality	"I absolutely don't trust what I find on the Internet. Every piece of information should anyway always be verified with a healthcare professional" (Male, 55, high HL)
Different approach for different issues		
Q12	No changes for more serious issues	"I would do the same thing, because I believe that in Google you can find specialized websites and therefore specific information as well" (Male, 33, low HL)
Q13	Longer and more in-depth search for more serious issues	"I did the same things, but my search was longer. I looked for way more information, in particular information that could be more easily trusted, such as scientific literature" (Male, 33, high HL)
Q14	Skip online search for more serious issues	"For small things it is useful to search on the Internet, so you don't bother your doctor with a trivial question. But there's a risk that by doing so you get scared or you think things are more serious than they actually are, whereas a physician could evaluate the situation immediately. Hence, for serious things you should definitely go directly to see a doctor" (Female, 39, high HL)
Evaluation criteria		
Q15	Position in Google results/Currency	"Not many, I chose the first ones [in Google]. Maybe I prefer those with a more recent date. I mean, if the first ones have an old date I skip them and go directly to the following, but more or less the first ones" (Female, 33, high HL)
Q16	Medical authorship	"I look for the word 'doctor' somewhere on the page. If it is not there, I leave" (Female, 40, high HL)
Q17	Author's credentials	"People need to look at the sources! Even my dog could start a health blog. It's up to the users to understand if the information is reliable or not. Whether a website is run by an institution or by amateurs, whether it is written by health professionals or by regular people" (Male, 29, low HL)

(*Continued*)

Quote #	**Main theme** Sub-theme	Participant's quote
Q18	Presence of ads	"Good websites don't need ads" (Male, 35, high HL)
Q19	Formal accuracy	"I interpret the use of grammar and syntax and the orthography as indications of the care that has been devoted to the preparation of information (Male, 35, high HL)
Q20	Currency	"I usually look at the dates. Of course some topics don't have an expiration date, in this cases I visit the website even if the date is old" (Female, 30, low HL)
Q21	Name or title of the website	"You know those websites with a weird name or URL? I don't even bother opening them" (Male, 37, low HL)
Q22	Commercial nature	"If there are no economic gains [for its authors] a website looks more reliable to me" (Male, 37, low HL)
Q23	Complementarity statement	"I trust them more when they say explicitly that the information on the website is not necessarily reliable, like Wikipedia for instance" (Female, 40, high HL)
Q24	Position in Google results	"Usually the first websites that appear [in Google] are the most trustworthy" (Male, 53, low HL)
Q25	Position in Google results	"[I trust a website] if the Google ranking system puts it in the first page" (Male, 28, low HL)
Q26	Position in Google results	"It depends on the position of the result in the search, if it is in the first two or three pages" (Male, 33, high HL)
Q27	Same information on several websites	"I open and read several websites. If the information is the same everywhere, of course it is also true" (Male, 61, low HL)
Q28	Overall appearance of the website	"I rarely open a page if I don't like the website. How a website looks like is crucial for me, it has to strike me" (Male, 37, low HL)
Q29	Other users' experiences	"I tend to trust more websites where real patients, who have applied the website's advice, can share their experiences" (Male, 33, high HL)
Q30	Other users' experiences	"Often websites are written by those who have the problem. They are not experts, how could they be reliable?" (Male, 28, low HL)
Q31	Interactive features	"Of course the forum sections on the websites are an interesting read, but everyone can write whatever he or she wants!" (Female, 41, high HL)
Q32	Subjective feeling	"I don't take all information I find for granted. I usually evaluate it following my sensations" (Male, 36, low HL)
Q33	Consistency with own ideas or knowledge	"If a website confirms what I had in mind I stop the search, I don't see the point of wasting time to search for something else" (Male, 53, high HL)
Q34	Ideological nature	"It's like when you find a vegan website. If you can smell an ideology, don't trust it!" (Male, 29, high HL)
Q35	Concrete examples	"I never trust information that does not refer to something concrete, real" (Male, 35, high HL)
Q36	Perceived number of users	"If a website has a lot of visitors, it is necessarily reliable" (Male, 37, low HL)
Q37	Complexity	"There should be at least some weird medical term that I don't understand" (Female, 40, high HL)
Outcome of the search		
Q38	Discussion with healthcare provider	"What I found online was useful to give me some basic knowledge. Then I asked my physician to explain to me what I hadn't understood and advice on what I had to do" (Male, 61, low HL)
Q39	Change in behavior	"I just assumed what I found on the Internet to be true and I used an empirical approach . . . I mean, I tried many of them to see which was the best for me and what was feasible because of the time constraints" (Male, 28, high HL)
Q40	GP visit without discussing the search	"[I didn't discuss the search with my GP] because it wasn't necessary. He addressed all my concern without me mentioning what I had found online and he gave me a lot of useful advice" (Female, 24, high HL)

2.4. Analyses

All interviews were recorded and transcribed verbatim. Qualitative thematic analysis [32] was conducted using MAXQDA 11 (VERBI GmbH, Berlin, Germany). A first, descriptive, coding procedure was aimed at classifying participants' narratives into themes defined on the basis of the interview guide. Following a constant comparative approach [33], when new themes appeared during the analysis of an interview, all interviews were reconsidered to find possible links with the new themes. In a second phase, identified themes were merged into broader categories, partly based on previous research on OHI seeking [34–36]. Existing web quality guidelines [37] were used to classify the evaluation criteria mentioned by the respondents as established or non-established. Qualitative analyses were performed by the first author and regularly discussed and agreed on by all authors. Quantitative analyses were performed using IBM SPSS Statistics 21.0 (SPSS Inc., Chicago, IL, USA).

3. Results

The final sample was composed by 44 individuals (see Table 1 for details). In the following paragraphs both quantitative and qualitative results will be presented. Relevant participants' quotes to illustrate the results from the qualitative interviews can be found in Box 1 and are referred to when the themes are mentioned throughout the text (*Q1–Q40*).

3.1. Health literacy and eHealth literacy

On average, participants answered correctly four out of the six questions (SD = 1.855) of the NVS. 52.3% of the participants ($n = 23$) were categorized as having low health literacy (average NVS = 2.57, SD = 1.409), and the remaining 47.7% ($n = 21$) as having high health literacy (average NVS = 5.57, SD = 0.507). Individuals with low health literacy were significantly less educated ($p = 0.013$), but the two groups did not differ with regard to gender ($p = 0.123$) and age ($p = 0.688$).

Participants scored on average 3.40 (SD = 0.734) on the eHEALS (average score, range 1–5), indicating a moderate perceived ability to perform OHI tasks. Respondents in the low health literacy group presented higher scores on the eHEALS ($p = 0.007$), thus perceiving themselves as more skilled in performing OHI seeking tasks – including the evaluation of OHI – than their high health literate counterparts.

3.2. Context of the search

Participants mentioned a wide range of ailments as the starting point for their search, from a common cold to searching for diseases such as multiple sclerosis or cancer. Motivations for searching online were manifold and were similar among individuals with low and high health literacy. Self-diagnosis (*Q1*) was the most commonly cited reason, together with the willingness to complement (*Q2*) information received by the GP. Other reasons included preparing a GP visit (*Q3*), simple curiosity about a health topic (*Q4*), willingness to find more information about a doctor or a hospital (*Q5*) and the impossibility to visit a healthcare professional (*Q6*). One respondent mentioned using the Internet to find information to challenge a diagnosis received from the GP (*Q7*). Several respondents mentioned the characteristics of the Internet (accessibility, immediate availability, and absence of costs) as the main incentives to choose it as a source. All participants used Google® for their searches, although in a few cases participants mentioned directly visiting specific websites they already knew (*Q8*).

3.3. Online health information quality awareness

A general tendency not to question the quality of OHI was observed in both the high and low health literacy groups, with only a minority of respondents spontaneously mentioning quality concerns when describing their OHI seeking experience (*Q9*). When asked explicitly, however, most participants appeared to be aware of the fact that not all information is of good quality. Only a few participants in both groups perceived OHI as being generally accurate. Most respondents in the low health literacy group stressed the fact that quality varies across websites (*Q10*). In the high health literacy group, instead, most respondents perceived OHI as being overall of low quality (*Q11*).

3.4. Different approaches for different topics

Depending on the seriousness of the ailment mentioned as the starting point for their search, participants were asked whether they had ever searched for information about a more, respectively less, serious health issue and whether this had changed their approach. If they never did, they were asked to think about what they would do in such a situation.

Only a minority of low health literate participants described an increased attention to quality in case of more serious health

Table 2
Evaluation criteria emerged from the qualitative interviews.

Established evaluation criteria[a]	Non-established evaluation criteria
Medical authorship	Position in search results
Identifiable authorship	Presence of other users' experiences
Absence of advertising	Looks of the website
Completeness of information	Same information on other websites
Formal accuracy of information	Unspecified subjective feelings
Institutional authorship	Style/tone of the information
Presence of author's credentials	Consistency with own ideas and knowledge
Commercial nature	Perceived number of users/diffusion
Complexity of information	Amount of information on the website
Informativity of title/name of the website	Non-ideological/magical/esoteric information
Presence of quality certificate (e.g. HON)	Specificity of information
User-friendliness	Previous knowledge of the website
Interactive features (e.g. chats, forums, etc.)	Perceived honesty
Readability of information	Information translated from another language
Currency of information	Encyclopedic nature of website
Reference to scientific publications	Presence of real-life examples
Presence of contact information	Website/images loading time
Presence of complementarity statement	Presence of pop-ups
Presence of informative illustrations	Reassuring information
	Focus on alternative medicine
	Interactive features (e.g. chats, forums, etc.)[b]
	Complexity of information[c]

[a] Based on the Health on the Net (HON) criteria (see Ref. [38]).
[b] According to established guidelines, presence of interactive features is related to increased quality, while these respondents ($n = 5$) viewed presence of interactive features in a negative perspective.
[c] According to established guidelines, presence of complex information is related to diminished quality, while these respondents ($n = 2$) viewed complex (medical) information in a positive perspective.

concerns. Most respondents in this group reported not modifying their online searches depending on the seriousness of the health issue (*Q12*). Most high health literate respondents, conversely, stated that they had given or would give more attention to quality for more serious issues. For some, increased attention to quality translated into a more rigorous search process (*Q13*), while for others this resulted in avoiding the online search completely and discussing the concern with a physician (*Q14*).

3.5. Use of evaluation criteria

Thematic analysis allowed the identification of 41 different criteria used by participants to evaluate the quality of OHI (Table 2). Criteria were often mentioned explicitly following a question about OHI quality or about the criteria they used to evaluate it. Sometimes, however, participants unconsciously referred to criteria when discussing other topics, such as problems encountered during the search. For instance one respondent, when discussing how many websites she had visited, unconsciously mentioned two evaluation criteria: *currency of information* and *position in search results* (*Q15*). Respondents in the low health literacy group mentioned – or implicitly referred to – less criteria than high health literate respondents did.

3.5.1. Established evaluation criteria

Only 18 out of 41 mentioned evaluation criteria could be considered as established according to existing quality guidelines. Respondents with low health literacy mentioned less established criteria compared to those in the high health literacy group. The most common established criteria in both groups were those related to authorship and included *medical authorship* (*Q16*), *identifiable authorship*, *institutional authorship*, and *presence of author's credentials* (*Q17*). These criteria were the only established ones shared by several people in the low health literacy group. All other established criteria were mentioned by only a few respondents in this group. Respondents in the high health literacy group, on the other hand, seemed to share a more diverse set of established evaluation criteria. *Absence of advertising* (*Q18*), *user-friendliness*, *completeness of information*, *formal accuracy* (*Q19*), and *reference to scientific publications* were all often mentioned by participants in this group.

Although overall the respondents referred to several established criteria, many of these – such as *presence of quality certificate*, *currency of information* (*Q20*), *presence of an informative title* (*Q21*), *commercial nature of information* (*Q22*), *complexity of information*, presence of *interactive features*, and *readability* – were mentioned only by few participants. Some established criteria – such as *presence of contact information*, *presence of a complementarity statement* to warn for the risk of only using Internet information (*Q23*), and the *presence of informative illustrations* to complement the information presented on the website – were never mentioned by individuals with low health literacy. Additionally, some of the criteria included in quality guidelines were not mentioned at all. These included *presence of functioning links*, *availability of a search function*, *explicit target audience*, *data protection guarantee*, and *presence of both risks and benefits of treatments* (e.g, [38]).

3.5.2. Non-established evaluation criteria

Most of the evaluation criteria referred to during the interviews could not be found in commonly used quality guidelines and are therefore to be considered non-established. Participants in both groups mentioned more non-established criteria than established ones. Overall, *position in search results* was by far the most commonly cited non-established evaluation criterion. Participants seemed to perceive the position of a website among Google® results as an indication of its quality, with better websites occupying the first positions. For some respondents this referred to the results on top of the first page (*Q24*), for others it referred to the complete first page of results (*Q25*), and for some it was an even less restrictive criterion (*Q26*). Interestingly, none of the participants made a distinction between sponsored and non-sponsored websites in Google®.

Participants in the low health literacy group often mentioned attributing importance to the fact that they could find the *same information on different websites* (*Q27*), and to the *looks of the website* when appraising the quality of a website (*Q28*). Value was also assigned to the *presence of other users' experiences*. Interestingly however, for some this was an indication of quality (*Q29*), whereas for others the complete opposite (*Q28*).

The *looks of the website* were perceived as important by people with high health literacy as well and so was finding the *same information on several websites*. A further criterion that was relatively commonly referred to in this group was the *presence of interactive features*. As respondents reported perceiving interactive features – which according to quality guidelines are an indicator of high quality – in a negative light, this was categorized as a non-established criterion (*Q31*). Respondents in both groups referred to several other non-established criteria, such as *unspecified subjective feelings* (*Q32*), *consistency with own ideas, knowledge or expectations* (*Q33*), the *style*, *amount*, or *degree of specificity* of the information on the website, the absence of *ideological, magical, or esoteric* information (*Q34*), whether they had *previous knowledge* of the website, perceived *honesty*, the absence of *translated information*, the *encyclopedic nature* of website, the presence of *concrete examples* (*Q35*), *loading time*, absence of *pop-ups*, the presence of *reassuring information*, references to *alternative medicine*, and *perceived number of users* of the website (*Q36*). Interestingly, some respondents in the high health literacy group considered high *complexity* of the information as an indicator of quality, whereas established guidelines consider complex information negatively (*Q37*). Each of these criteria, however, was cited by a limited number respondents.

3.6. Outcomes of online health information seeking

When discussing the outcomes of their search, most participants reported discussing with a healthcare provider what they found online (*Q38*) or to have somehow modified their behavior (*Q39*). Discussions with a healthcare provider, as well as behavior modifications, appeared to be more common among respondents in the low health literacy group. Other commonly mentioned outcomes in both groups were a visit to the physician without mentioning the online search (*Q40*) and no changes in the behavior. None of the respondents mentioned changes in doctors or hospitals, decisions to undergo preventive care (e.g., cancer screening), or choosing an alternative treatment to what had been prescribed by a health care professional.

Only very few participants reported to have considered the quality of the information when deciding what to do with the information they had found online. Among these respondents, only one was in the low health literacy group.

4. Discussion and conclusion

4.1. Discussion

Health literacy is deemed to play an important role in OHI seeking and, according to several definitions, it includes the ability to evaluate health information [7]. Past research on OHI evaluation has, however, only rarely addressed the role of health literacy [13]. The main aim of this study was to explore similarities and differences in OHI quality evaluation among

people of different health literacy levels and to suggest a possible explanatory theory of the relationship between the two constructs.

The thematic analysis of the semi-structured interviews provided new insights on the role played by health literacy in OHI evaluation. Although our findings show that evaluation of OHI is problematic in both groups, there are some indications that these problems might be more prevalent among individuals with low health literacy. Despite perceiving themselves as more eHealth literate, participants in this group appear to know less established evaluation criteria, rely more heavily on non-established ones, adapt less often their evaluation strategies in function of the seriousness of their problem, and consider more rarely information quality when deciding whether to act on OHI than their high health literate counterparts. Besides being an indication that health literacy might indeed play a role in OHI evaluation, as it is implied by several health literacy definitions [39], this finding could also be considered a further indication that the eHealth Literacy Scale (eHEALS) does not necessarily capture people's skills in dealing with OHI, but it is a measure of self-efficacy, as suggested by van der Vaart et al. [40]. This result could thus be interpreted in light of the fact that – as it has also been shown – individuals with low health literacy are less aware of the issue of OHI quality and as a consequence they are less critical about their ability to evaluate it.

Regarding use of evaluation criteria, our analyses suggest that people with low and high health literacy not only differ in the criteria they use (both established and non-established), but also in the extent to which they rely on them. This result is an important addition to past studies conducted in low or high health literacy only samples, not allowing to draw conclusions on whether and to which extent their findings could apply to the other group [3,17]. Our study also provides us with a comprehensive list of non-established evaluation criteria that are applied by both high and low health literate individuals. These criteria mainly differ from established ones for being highly subjective. Whereas determining whether a website provides contact information or whether there are pictures to complement the information can be fairly straightforward, assessing the looks of a website could lead to different conclusions for different people. Moreover, some non-established criteria rely strongly on contextual information (e.g., position in search results). As such, they are not suitable to be used to assess an individual website. Knowing these criteria, in addition to the ones included in quality guidelines, will be crucial for the design of future studies to quantitatively assess how health literacy interacts with people's use of evaluation criteria in explaining their evaluation and subsequent use of OHI.

Last, our results corroborate and enrich the findings of early works on OHI evaluation [3,16,17]. They, first of all, confirm a generalized lack of awareness of the issue of OHI quality, which was spontaneously mentioned only by few respondents. Secondly, our analysis shows that, almost fifteen years after the first studies on the topic, many people still do not know and systematically apply the evaluation criteria that have been proposed by researchers in the field. This does not mean that people do not use criteria to evaluate OHI, but that they often use non-established ones. Several of the non-established criteria referred to by our participants, such as the position of a website in search results or the appearance of the website, are similar to the ones that had been identified in past research. This result is particularly striking considering that, in general, users are more used to computers and might have improved their ability to interact with OHI. For instance, contrarily to what had been noted in previous studies (e.g., [18]), none of our participants reported technical difficulties in using the Internet or in finding health information.

The main limitation of this study is related to its retrospective nature and to the consequent reliance on participants' recall of past experiences. This, in addition to the fact that participants often were not able to describe how they evaluated OHI, might have resulted in incomplete or selective reporting. Secondly, the design of our study necessarily required participants to have previous experience with OHI. This may have introduced a bias in our results, as OHI-seekers have probably a more positive attitude towards the Internet and its use for health purposes than non-seekers. However, our analyses showed a high variety of positive and negative attitudes towards OHI, making us confident in the validity of our results. Moreover, although understanding an investigation of the non-seekers' perspective on the topic could bring interesting insights on the phenomenon, this was beyond the scope of this study. Last, as it is the case for all qualitative research, our conclusions on differences between people with different health literacy levels cannot be generalized [41]. On the other hand, using a qualitative approach proved to be essential to explore attitudes towards OHI quality from the users' perspective and to elicit commonly used non-established evaluation criteria. As often individuals were not immediately aware of their attitudes, it is likely that some themes would not have emerged in a less interactive interview setting (e.g., using a questionnaire).

4.2. Conclusion

This study offers important new insights on the role played by health literacy in people's OHI evaluation. Individuals with low health literacy appear to use less established evaluation criteria and to rely more often on non-established criteria. These findings support what was expected based on indications from a recent systematic literature review [13] and past research [3,14–17,19], and provide us with a more nuanced understanding of the phenomenon. Following our analyses, differences in OHI evaluation among people with different health literacy levels might be related to differences in awareness of the issue of OHI quality and to knowledge and use of different evaluation criteria. Future research should quantitatively investigate the interplay between health literacy, use of established and non-established evaluation criteria, and ability to evaluate OHI.

4.3. Practice implications

The lack of attention to OHI quality and the reliance on non-established evaluation criteria should be taken as a warning that public health communication and patient education have failed to adequately address this issue. As this skill is crucial for patients to navigate the OHI environment [42], further efforts should be undertaken to improve citizens' ability to evaluate OHI. Particular attention should be devoted to the promotion of established evaluation criteria that are easy to use and effective in helping people to correctly evaluate OHI, and to hinder the use of non-established ones. Most importantly, public communication and patient education efforts should take into account that individuals with low health literacy might overestimate their evaluation ability. To motivate them to learn new evaluation criteria, it will be necessary to first raise awareness about their utility and to show why the criteria they currently use are not suitable.

Conflict of interest

None declared.

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Appendix A. —Topic list qualitative interview

Probes (in italics) were used only if the interviewee did not mention the topic spontaneously.

Part 1 Recent experience with online health information seeking

Question 1. Could you describe the last time you searched for health-related information online?

- *What was it about?*
- *Could you describe the circumstances?*
- *Why did you decide to search for this information on the Internet (and not elsewhere)?*
- *Could you describe what you did?*
- *Did you use a search engine (e.g. Google)?*
- *Did you type the address of a specific website? How do you know this website?*
- *How many website did you visit before finding the information you were looking for?*
- *Why did you discard some of them?*
- *How did you chose a website?*

Question 2. Did you encounter any problems during the search?

- *What kind of problems?*
- *How did you solve them?*

Question 3. Do you think that the information you found was useful?

- *Why (not)?*
- *Did you follow the indications you found on the website? Why (not)?*
- *Did you discuss what you found online with an healthcare professional (e.g. your physician or pharmacist)? Why (not)?*
- *What do you think of the possibility to discuss with an healthcare professional about the information you find on the Internet?*

Part 2 Credibility judgement

Question 4. Overall, how much do you trust the health-related information that can be found online?

- *Why?*

Question 5. What would you say are the **3 aspects** that are most important in making a health-related website credible for you?

- *Why?*

Question 6. And what about the **3 aspects** that are most important in making a health-related website NOT credible for you?

- *Why?*

Question 7. Did you ever search for information on the Internet on more [*respectively less, if serious health issue*] serious health issues?

- *[If yes] Did you do the same things? What did you do differently? Why?*
- *[If not] Would you do the same things? What would you do differently? Why?*

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