

This is a preprint of an article accepted for publication in JASIST: Choi, W. (2020). Older adults' credibility assessment of online health information: An exploratory study using an extended typology of web credibility. *Journal of the Association for Information Science and Technology*, 71(11), 1295–1307. <https://doi.org/10.1002/asi.24341>

Older Adults' Credibility Assessment of Online Health Information: An Exploratory Study  
Using an Extended Typology of Web Credibility

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### Abstract

Credibility assessment is a crucial component in the process of people's health information-seeking, especially in the web context. Finding "credible" health information from a plethora of information on the web may be more challenging for older adults, who have relatively less experience with the Internet. This paper reports on the findings of an exploratory study of older adults' credibility assessments of online health information. The data collected through semi-structured interviews with 21 older adult Internet users in the United States were analyzed based on the extended typology of web credibility (Choi & Stvilia, 2015). The findings of the study revealed that older adults paid closer attention to operator-related credibility cues and heuristics when judging the credibility of health information on the web, followed by content- and design-related ones. Also, the findings suggest that participants who were younger and used the Internet more frequently employed a wider variety of cues and heuristics to evaluate the credibility of online health information. Based on these findings, both theoretical and practical implications of the research and future research directions are discussed.

*Keywords:* information credibility, web credibility, credibility assessment, health information, online health information, older adults

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Older adults are an increasingly prominent user group on the web; 66% of older American adults (aged 65 or older) used the Internet as of 2018, up from 14% in 2000 (Pew Research Center, 2018a); also, about 37% of this age group used social media such as Facebook and Instagram as of 2018, a noticeable increase from only 3% in 2005 (Pew Research Center, 2018b). Considering that 75% of older American adults live with one or more chronic conditions such as cancer, diabetes, and hypertension (Buttorff, Ruder, & Bauman, 2017), health and wellness is a common topic of their information seeking on the Internet (Chaudhuri, Le, White, Thompson, & Demiris, 2013). However, it is challenging for them to select quality health information from the Internet due to various reasons. These reasons include their lack of expertise in a given health topic and limited experience with the Internet, which has unique characteristics as a medium of health information such as relative lack of source attributions and ease of reproducing and redirecting content across varied web platforms (Danielson, 2006).

The elaboration likelihood model (ELM) by Petty and Cacioppo (1986) divides the process of information processing and assessment into two routes depending on the depth of the user's motivation and ability to scrutinize it—central route and peripheral route. The model posits that people with a stronger motivation and ability are more likely to use the central route, in which they elaborate on (scrutinize) the quality of the information they obtain. In contrast, those who lack motivation, ability, or both use the peripheral route, in which they tend to rely on simple “cues” (Petty & Cacioppo, 1986)—superficial elements of an information resource influencing the evaluators' estimation of the quality of the information—and “cognitive heuristics” (Chaiken, 1980)—rules of thumb or mental shortcuts that help them reduce cognitive load and ability required for information processing and decision making. For example, people who use the peripheral route may consider the name of the source as a cue to make a heuristic evaluation that more famous information sources are associated with higher information quality. Based on ELM, although the model has not been developed specifically for older adults on the web, older adults can be seen as a web user group whose online health information seeking is more likely to use the peripheral route rather than central route, in that their motivation for seeking health information is high (Chaudhuri et al., 2013), but their ability to select valid health information on the Internet is relatively low (Castle et al., 2012; Zulman, Kirch, Zheng, & An,

2011). When compared with their younger counterparts, the current cohort of older adults go online less frequently and are less confident when using online services (Anderson & Perrin, 2017). Also, neurologically, older adults tend to be less effective than young adults at making explicit judgments of cues of untrustworthiness due to decreased neural activity in the anterior insula—a region in the human brain that contributes to decision making by instantiating subjective feeling states when perceiving and interpreting untrustworthy visual cues (Castle et al., 2012). Older adults, therefore, can be considered a vulnerable user group on the web.

Despite the increase in older adult Internet users, their need for health information, and the difficulties they face when seeking credible health information from the Internet, there is a dearth of research focusing on this age group's perceptions and behaviors related to credibility assessment of online health information. The majority of research in the past 2 decades has focused on younger generations such as college or high school students (e.g., Eastin, 2001; Eysenbach, 2008; Flanagan & Metzger, 2008; Hargittai, Fullerton, Menchen-Trevino, & Thomas, 2010; Hilligoss & Rieh, 2008; Hong, 2006; e.g., Liu, 2004; Rieh & Hilligoss, 2008; Rowley & Johnson, 2013) or explored the perceptions of the general population with a wide range of age groups (e.g., Appelman & Sundar, 2015; Fogg et al., 2003; Princeton Survey Research Associates, 2002; Savolainen, 2011). Some studies have examined general older adults' distrust of health information on the web compared to that from more traditional types of sources, especially interpersonal sources such as physicians, pharmacists, and family (Chaudhuri et al., 2013; Miller & Bell, 2012; Zulman et al., 2011). Findings from such studies often highlighted the influences of information technology (IT) proficiency or experience with the Internet on older adults' distrust of online health information. However, relatively little is known about how older adults who actually use the Internet for health information seeking as part of their everyday lives perceive and evaluate the credibility of online health information. To address this gap in the literature, the present study conducted semi-structured interviews with older adult Internet users in the United States. The qualitative interview data provide deep insights into the characteristics of older adults' credibility assessment of online health information, which is rare in the credibility literature.

### **Credibility in the Web Context**

Credibility of web-based information resources is called *web credibility* (Fogg, 2003a). Web credibility is rooted in the traditional concept of credibility, which has long been studied in

the context of the persuasiveness of sources in interpersonal communication settings (Hovland, Janis, & Kelley, 1953; Hovland & Weiss, 1951; Kelman & Hovland, 1953). However, assessing the credibility of web-based resources is considered more complex, because the object of the assessment (e.g., website, blog, social networking site) has media-specific features that are missing in interpersonal communication or traditional mass media such as television and radio (Choi & Stvilia, 2015). Therefore, web credibility adopts the conceptualization of traditional credibility—which consists of two underlying dimensions, trustworthiness and expertise (Hovland et al., 1953)—but accommodates the influences of the medium-specific characteristics on people's credibility perceptions. Danielson (2006), for example, defined web credibility as “a characteristic of information sources that influences message persuasiveness, attitudes toward the information source, and behaviors relevant to message content, consisting of two primary attributes, expertise and trustworthiness” (p. 721). Fogg (2003a) also viewed web credibility as consisting of the two dimensions, trustworthiness and expertise, but noted that various types of web elements come into play in people's web credibility assessments.

In the literature, scholars have proposed different theoretical frameworks and models of web credibility assessment, identifying key factors affecting people's perceptions of web credibility and conceptualizing the processes of assessing the credibility of online information in different contexts (e.g., Fogg, 2003b; Hilligoss & Rieh, 2008; Lucassen, Muilwijk, Noordzij, & Schraagen, 2013; Metzger, 2007; Wathen & Burkell, 2002). Although these theoretical works possess somewhat different perspectives and focal points in web credibility assessment, they share the common idea that web credibility assessment involves various types of cues—elements of a web interface (e.g., uniform resource locator [URL], ads) (Fogg, 2003a)—and heuristics—rules of thumb employed to judge the credibility of online information with minimum cognitive effort (e.g., bandwagon heuristic: “I trust the information because others do so”; (Hilligoss & Rieh, 2008; Metzger, Flanagin, & Medders, 2010; Sundar, 2008)—related to the characteristics of the source, message, and medium (i.e., Internet). Also, the existing theoretical works posit that web credibility assessment is based on the evaluator's perceptions, which are often subjective and influenced by various personal and contextual factors, such as demographic background, level of involvement, topic familiarity, and IT proficiency, rather than being objective and consistent (see the analysis of existing frameworks of web credibility assessment by Choi & Stvilia, 2015). Such research evidence warrants further investigation of web credibility

assessments in a specific user group expected to be different than other user groups, such as older adult Internet users, by taking user characteristics and web-specific features into consideration.

### **Older Adults' Credibility Assessment of Health Information on the Web**

Analysis of the literature shows that age is an important variable explaining people's credibility assessment of online health information (Sbaffi & Rowley, 2017). More specifically, older adults tend to have more concerns or doubts about the credibility of health-related resources on the web (Hesse et al., 2005; Rideout, Neuman, Kitchman, & Brodie, 2005). Even among older adults, age is a significant factor predicting a lower level of trust among older-old adults (aged 85 or older) compared to younger-old adults (aged 65–84; (Le, Chaudhuri, White, Thompson, & Demiris, 2014). Fisk, Rogers, Charness, Czaja, and Sharit (2009) found that older adults' distrust in online health information may be derived from their expectations about how a system should work, which are mainly based on how previous versions (i.e., nonelectronic) were structured. Thus, older adults may assume that the credibility of online health information is lower than that of printed information because they are more familiar with printed information that is produced and disseminated through a stricter quality-control process that involves editing, reviews, and other gatekeeping procedures (Danielson, 2006).

The fact that older adults have more concerns with credibility issues, however, does not necessarily mean they can seek out indicators of credibility when exploring web-based health information. Research evidence has shown that older adults tend to have lower e-health literacy than their younger counterparts (Neter & Brainin, 2012; Tennant et al., 2015), meaning older adults are less “able to seek, find, understand, and appraise health information from electronic sources and apply the knowledge gained to addressing or solving a health problem” (Norman & Skinner, 2006, para. 6). Robertson-Lang et al.'s (2011) study, for example, revealed this tendency: Many older adult participants in their study made credibility judgments of health-related websites without checking obvious credibility cues such as the site sources. Research also has shown that the association between age and distrust in online health information among older adults is moderated by their familiarity and proficiency in using the Internet (Miller & Bell, 2012; Zulman et al., 2011). These findings suggest that older adults are a unique user group of online health information that deserves further investigation. As previously mentioned, research

is lacking on older adults' web credibility assessment of health information, and this study aimed to close this gap in the credibility literature using the following research questions.

1. What are characteristics of older adults' credibility assessments of online health information?
2. What variability factors (e.g., age, Internet experience) affect older adults' credibility assessments of web-based health information resources?

### **Theoretical Framework**

Choi and Stvilia (2015) suggested an extended typology of web credibility by cross-mapping the two key dimensions of web credibility based on the original definition of credibility by Hovland et al. (1953)—trustworthiness and expertise—with the three categories of elements on websites that affect people's perceptions of web credibility as suggested by Fogg (2003a)—operator, content, and design. Trustworthiness has been defined as “the degree of confidence in the communicator's intent to communicate the assertions he [the communicator] considers most valid” (Hovland et al., 1953, p. 21). In the web context, trustworthiness can be defined as the site's perceived intent to provide valid and accurate information to users. Expertise in the interpersonal communication context is defined as “the extent to which a communicator is perceived to be a source of valid assertions” (Hovland et al., 1953, p. 21). In the web context, expertise is the site's perceived ability to provide information that is valid and accurate.

An operator is a personal or organizational agent offering a website or an author contributing content to a web platform (e.g., those posting online articles on blogs, adding comments to others' entries, and replying to questions posted on social Q&A sites). Content is the information being presented on the site (e.g., text, images, sounds), which has semantic and structural features. Design refers to how the site is put together in terms of structural (e.g., information architecture), technical (e.g., stability, usefulness), aesthetic (e.g., look and feel), and interactive (e.g., usability, user experience) features (Fogg, 2003a).

The cross-mapping of the two dimensions of credibility and the three types of web elements results in six types of web credibility: operator trustworthiness, operator expertise, content trustworthiness, content expertise, design trustworthiness, and design expertise. Each credibility type can be defined by combining the definitions of the key concepts. For example, operator trustworthiness is defined as the characteristics of the operator of the website or author of the content that affect the user's perception of the site as having the intent to provide valid and

accurate information. Operator expertise, however, focuses on the operator's or the author's ability rather than intent to provide valid and accurate information. This rule is applied to define other types of web credibility as follows: content trustworthiness and content expertise refer to the semantic and structural attributes of the content that affect the user's perception of the site as having the intent (i.e., **trustworthiness**) or ability (i.e., expertise) to provide valid and accurate information. Design trustworthiness and design expertise refer to the structural, technical, aesthetic, and interaction design features affecting the user's perception of the site as having the intent or ability to provide valid and accurate information. The main idea of this cross-mapping exercise is that credibility is the root concept of web credibility and therefore, these three web elements that serve as credibility cues have an impact on the perceived trustworthiness or expertise (or both) of the website.

Furthermore, the extended typology identifies various audience factors known to influence people's web credibility assessments such as demographic factors (e.g., age, gender) and technology proficiency (Choi & Stvilia, 2015). Thus, the extended typology can be used to understand the variability in people's perceptions and behaviors regarding web credibility assessment by taking user characteristics into consideration.

Given the complex dynamism in web credibility assessment, due mainly to the unique characteristics of the web as a medium, and the potential influences of various audience factors (e.g., age, technology proficiency), the extended typology is a useful lens for researchers to articulate the relationships among various web elements (i.e., credibility cues) and the dimensions of web credibility, highlighting the sources of credibility issues in the web context. The present study, therefore, used this framework as an initial coding scheme to analyze interview data, which were collected during semi-structured interviews with older adult Internet users.

## Methodology

**Semi-structured interviews were conducted with 21 older adults to develop a comprehensive understanding of their credibility assessment of online health information.** This type of interview is well suited to exploring the perceptions and opinions of respondents regarding complex issues and provides opportunities to probe for more information and clarification of answers (Barriball & While, 1994). The target population of this study was older American adults who regularly use the Internet to seek health information. In the present study,



older adults were defined as 55 years old or older based on Neugarten's (1974) definition, with subcategories of young-old (55–74 years old) and old-old (75+ years old) adults. This was adopted as a useful framework to identify potential age differences in perceptions of web credibility among older adults. In addition, because the study focused on online health information, older adults who had not looked for health information online were excluded. Potential participants had to have searched for health information at least once during the past 6 months. This sampling criterion was also beneficial for recall.

### Procedure

A lifelong-learning center at a university in the southern United States was the initial recruitment site where the researcher identified several participants and sought additional participants using the snowball sampling technique. The administrative staff sent out an invitation message to members via email, introducing the research purpose and design. Potential participants were asked to contact the researcher via email or telephone. Before scheduling an interview, each participant had to pass a prescreening test based on the Short Portable Mental Status Questionnaire (SPMSQ; Pfeiffer, 1975) and the Wechsler Memory Scale III (WMS-III; Wechsler, 1997). **SPMSQ is an instrument developed to assess the presence and degree of intellectual impairment using 10 simple questions (e.g., date, names of former presidents). WMS-III is an instrument developed to assess memory involving reading aloud a short story, then recalling as many words as possible.** The researcher determined if the participant passed the prescreening test based on the following cutoff points: fewer than three errors in SPMSQ (Pfeiffer, 1975) and recall of six or more words in WMS-III (Wechsler, 1997). The prescreening test ensured that the participants' cognitive function was adequate for the study, which relied on participants' recall. No disqualifications occurred due to the prescreening.

The researcher interviewed each participant at a site of the participant's choosing (e.g., participant's house, local library branch). In the opening segment, the researcher explained the purpose of the study and the participant read and signed an informed consent form. Each participant was reminded of the fact that the interview would be voice recorded, as stated in the consent form. In the middle segment, the researcher asked main interview questions about (1) older adults' health information needs in their everyday lives, (2) interpersonal and online sources they used to gather necessary health information, and (3) credibility cues and heuristics they employed to assess the credibility of health information on the Internet. Findings regarding

the first two sets of questions on older adults' health information needs and sources used in their health information-seeking were reported elsewhere [blinded for review]; the present paper reports the findings regarding the third set of questions on older adults' credibility assessment of web-based health information resources.

Regarding the third set of questions, participants were first asked to answer two open-ended questions: (1) *How do you evaluate credibility of a health-related website?*; (2) *Which markers/cues on the website make you perceive it as credible?* These questions were intended to encourage participants to talk freely about what makes them perceive certain online health information as credible. Then they were asked to answer Likert scale-based questions, which listed varied types of credibility cues and heuristics selected from past research (e.g., the author's credential for an article, typographic errors, broken links, contact information; Choi, 2013; Fogg et al., 2001; Fogg et al., 2003). *The Likert-type questions followed the open-ended questions to help participants discuss the cues and heuristics that they might not otherwise think of.* As they answered both the open-ended and Likert-type questions, they talked about the effects of such cues and heuristics on their credibility perceptions as to whether they were positive, negative, or neutral. To stimulate responses regarding the credibility cues and heuristics participants used, the researcher used a laptop to show the participants the websites they had identified as credible or noncredible regarding health information. *It should be noted that the present paper only reports findings from the qualitative verbal data rather than numerical responses to the Likert-type questions, considering the small sample size ( $N = 21$ ) and qualitative and exploratory nature of the investigation.*

In the final segment, the researcher addressed questions that participants had and *thanked them for their participation.* Each of the first 19 participants received \$10 and the last two participants received \$25 in exchange for their participation. The incentive was increased to encourage the potential subjects' participation in the study; this change was approved by the institutional review board at the researcher's affiliated university.

### **Participants**

Twenty-one older adults participated in the study. Their ages ranged from 61 to 80 years old ( $M = 70.3$ ,  $SD = 5.6$ ). *Of the 21 participants, 15 (71.4%) were young-old adults; six (28.6) were old-old adults.* Sixteen (67.2%) were women. Nineteen (90.5%) were Caucasian; the rest (two of 21; 9.5%) were African American. Participants' education levels were overall very high:

15 (71.4%) graduated from college; five (23.8%) took some college courses but did not obtain a college degree; and only one participant (4.8%) did not experience any higher education. Regarding weekly Internet usage, six (28.6%) went online for 1–10 hours a week, eight (38.1%) did so for 11–20 hours a week, and seven (33.3%) did so for more than 20 hours a week. All participants had more than 5 years of Internet experience.

The characteristics of the study sample may not reflect the broader older adult population. However, the sample's profile was in line with that of the target population: American older adults who use the Internet on a regular basis. Based on recent nationwide surveys (Alijanipour et al., 2014; Smith, 2014), American older adults who use the Internet tend to be younger than 75 years old and highly educated.

### Data Analysis

All interviews were transcribed verbatim. As mentioned, the extended typology of web credibility (Choi & Stvilia, 2015) was used as the initial coding scheme for the interview data analysis. Given the significant body of literature on web credibility assessment and the extended typology representing the product of an extensive review of the literature (Choi & Stvilia, 2015), a priori codes derived from the typology facilitated the exploration of the data. Although the coding process was guided by the coding scheme, the researcher also looked for emerging themes (open-coding technique). The results of coding showed that the extended typology (Choi & Stvilia, 2015) was broad enough to cover all credibility cues and heuristics mentioned by older adults during the interviews. This study, however, expanded the examples of credibility cues and heuristics that were introduced in Choi and Stvilia's (2015) original work.

A third-party coder checked the dependability of the coding results (Lincoln & Guba, 1985). Each coder first coded a transcribed interview independently. The coders then had an in-person meeting to compare their coding results and discuss differences in their codes (e.g., different credibility types were assigned to the identical statement; an obvious code was not assigned to a statement by either coder). Based on the discussion, they refined the rules for assigning codes. Using the refined coding scheme, both coders coded another interview together, reading the transcript line by line, to further refine the coding scheme by exchanging opinions immediately when any disagreements or discussion points emerged. The researcher then recoded all interviews based on the final coding scheme refined through the second round of code review. The computer software QSR NVivo 10 (QSR International, 2014) facilitated the data analysis.

## Findings

The subsequent sections present cues and heuristics used in older adults' credibility assessment of online health information based on the six credibility types identified in the extended typology (Choi & Stvilia, 2015).

### Older Adults' Credibility Cues and Heuristics

**Operator trustworthiness.** Operator trustworthiness refers to the characteristics of the operator of the website or author of the content that affect the user's perception of the site as having the intent to provide valid and accurate information. Nineteen of the 21 participants (90.5%) mentioned credibility cues and heuristics regarding this credibility type. They paid special attention to the operator's main intent for running a health-related website (or the author's intent to post an article on health topics), attempting to examine if it was to make commercial profits, as opposed to serving the public interest. Quotes from Participant 9 (P09) and P14 reflect overall opinions that nonprofit sources are perceived as more trustworthy. P09 stated: "One is the nature of the organization that provides the website. Is it a nonprofit organization or is it attempting to sell me a product?" Similarly, P14 described:

I try to go first to .gov or .org sites because they don't have something to sell to me. Also, I go to academic sites. ... I'm generally trying to verify that information from a more independent source, and I perceive that an academic institution or a nonprofit foundation. For example, the Arthritis Foundation might be a better source than .com sources. I think the nonprofit sites, their purpose is to educate generally, and they have public interests. That's not related to profit, whereas I think that some of the .com sites, well, they may have good information, often reliable information, [but] they generally have a profit motive.

In the same context, presence of commercial advertisements on a website seemed to significantly decrease the perceived trustworthiness of the site. For example, participants expressed hostility toward being exposed to unwanted advertisements with commercial intents, especially in the form of pop-up windows. P03 stated: "It has happened, pop-up on the computer when I'm using it. I pay no attention to it at all because their interests and mine are not necessarily perfectly coincided." In the same context, P04 stated: "Do you want to know some negative markers? No advertising at all."

**Operator expertise.** Operator expertise is another source-related credibility type that indicates the operator's (or author's) perceived ability, as opposed to perceived intent, to provide valid and accurate information. Many participants (15 of 21; 71.4%) considered websites run by real-world institutions that have a good established reputation in their given medical fields as credible. Examples of such institutions included the National Institutes of Health, Centers for Disease Control and Prevention, and Mayo Clinic. The participants valued the fact that these institutions have been around for a reasonable period of time, producing research-based medical evidence. **For instance, P10 stated:** "If I search and pops up Johns Hopkins, I might not look at any of the cues. Okay? I'm going by name recognition." **P02 also stated:** "I tend to go to a site that is reputable like Hopkins or Mayo, where you know they're not going to be putting up false information. You can depend on it, having been pretty reputable stuff."

However, participants did not always consider research-based institutions to be credible sources of health information when they were relatively new and therefore, less familiar to the participants, or perceived as small.

People who don't agree with the research, maybe there's small research that has a different result and this is what it shows. I want to see that there's been an enormous study group over a reasonable period of time, which can be years. (P04)

Some participants checked the site operator's education and training to judge the credibility of the site, especially when they were not familiar with the operator or site. Quotes from P01 and P10 illustrate this point. "If I was looking at a private physician or private practice's website, I'll go and look at their providers and see where they're trained, well, if they're certified, that kind of thing" (P01).

If it's a site that I haven't been to, then I'm going to look at the masthead kind of thing that has who's running the site; are there doctors, are they MDs or PhDs? ... I look to see who's on their staff, basically, how well trained, what kind of training their staff have. (P10)

Several participants were skeptical about social media as credible sources of health information, stating that anonymous authors on social sites lack expertise on given health topics. Therefore, health information on social media was considered to be personal opinions rather than facts. **P21, for example, stated:** "I won't be looking for general people's opinions." **Similarly,**

**P17 described:** “Everybody’s got their opinion, but a lot of those opinions are not based on fact. They’re just opinions. They may have read a book and think they know everything.”

**Content trustworthiness.** Content trustworthiness concerns the semantic and structural attributes of the content that affect the user’s perception of the site as having the intent to provide valid and accurate information. Some participants (eight of 21; 38.1%) examined whether the information (message) itself was biased by cross-checking multiple sites addressing the same topic. P21 pointed out that health information from one site was not always reliable and might not be in line with the common view in the field:

Sometimes, I spend a whole day going from one website to another. I take notes because I will find the same information on several websites. Then I believe. I don’t really know, but then I believe that this information is correct.

They also looked at whether information on a website was outdated. They considered outdated health information neither useful nor trustworthy. **For example, P14 mentioned:** “I’m cautious about Wikipedia. ... I always verify the information because it’s not always updated.”

**P15 also mentioned:** “For this one [a Facebook page on Lyme disease], it’s very current. Current and new findings, new news. ... They have recent posts and contacts. There it is about the Lyme disease today, which I might do.”

**Content expertise.** Some participants (11 of 21; 52.4%) commented on the expertise of the content—semantic and structural attributes of the content that affect the perceived ability of the site to provide valid and accurate information. For example, they perceived an online article as credible when it was based on research evidence and provided research sources that authenticated the information conveyed in the article. **P09 stated:** “It references high-quality journal articles, and they seem to be credible to me. ... The Cochrane Collection collects journal articles where there’s actual evidence been collected, medical evidence been collected, to verify that hypothesis.” **P20 also stated:** “When you’re pulling information off the Internet, if it’s an article, if you look at the very last, check the references. What I found on health is, if there’re medical associations, then when you check those references, it will tell you whether this article is just an opinion.”

Another point addressed the intrinsic quality of the content. P07, for example, mentioned that if an article had any errors in grammar, syntax, or punctuation, she would discount the credibility of the article.

**Design trustworthiness.** Design trustworthiness refers to structural, technical, aesthetic, and interactive features that affect the user's perception of the site as having the intent to provide valid and accurate information. In general, older adult participants in the present study did not express concern about the site's design trustworthiness when evaluating the credibility of health-related websites. Two participants (9.5%) mentioned the site's technical stability (e.g., always up and running, all links working properly) or real-world feel (e.g., displays the operator's picture and contact information) as neutral cues that had no impact on their web credibility perceptions.

**Design expertise.** Some participants (nine of 21; 42.9%) mentioned that design features might influence their perceptions of the expertise of health-related websites (i.e., ability to provide valid and accurate health information). For instance, they said good information architecture and usability attributes that helped them find needed health information affected their perceptions of the site's credibility.

One of the things I like about the Mayo website is if you go and look up something, it'll have just enough to read on a page, and then ... you can click on another page to find out more about part of the area. It doesn't overwhelm you. (P08)

Another important finding was that design features could significantly decrease the perceived credibility of the site; these design influences could be separated from those of the other two types of credibility cues—operator and content.

It's got a terrible, terrible user interface. It's awful. It's horrible. It's like something done in 1910. Just awful, but get down to the bottom of it. It's got a diagnostic tree. If you have this symptom, then go on to this one. The information on the bottom of it is pretty credible and good, but it's awful to use. (P09)

Table 1 presents the credibility cues and heuristics mentioned by study participants, organized by Choi and Stvilia's (2015) six types of web credibility. The plus (+) or minus (−) sign next to each credibility cue or heuristic indicates whether participants said the cue or heuristic had a positive or negative impact on their credibility perceptions.

Table 1

*Cues and Heuristics by Credibility Type*

Credibility Type	<i>n</i> (%)	Cues and Heuristics
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Operator Trustworthiness	19 (90.5)	<ul style="list-style-type: none"> <li>• Focus on disseminating useful health information to the public (+)</li> <li>• Commercial intent (e.g., ads) (–)</li> </ul>
Operator Expertise	15 (71.4)	<ul style="list-style-type: none"> <li>• Established reputation as research-based institutions over a reasonable period of time (+)</li> <li>• Credentials or specialties appropriate for given health topics (+)</li> </ul>
Content Trustworthiness	8 (38.1)	<ul style="list-style-type: none"> <li>• Unbiased information (e.g., the same information is found from multiple sources) (+)</li> <li>• Current information (+)</li> <li>• Outdated information (–)</li> </ul>
Content Expertise	11 (52.4)	<ul style="list-style-type: none"> <li>• Provision of research-based evidence (e.g., references to high-quality peer-reviewed journal articles) (+)</li> <li>• Poor intrinsic quality (e.g., typos, grammatical errors) (–)</li> </ul>
Design Trustworthiness	2 (9.5)	<i>Mentioned as neutral cues (e.g., the site's technical stability)</i>
Design Expertise	9 (42.9)	<ul style="list-style-type: none"> <li>• Good usability (e.g., easy to use, easy to navigate) (+)</li> <li>• Bad usability (e.g., hard to find needed information) (–)</li> <li>• Old-fashioned look and feel (–)</li> </ul>

### Variability in Older Adults' Web Credibility Assessments

Table 2 presents the frequencies of participants' mentions of the six web credibility types by age—young-old (55–74 years old) and old-old (75+ years old) adults—and weekly Internet usage, two notable factors contributing to variability in the frequencies. The descriptive frequency data show that participants who were younger and used the Internet more hours per week identified more varied types of credibility cues and heuristics than their counterparts who were relatively older and use the Internet less.

Table 2

*Mentions of the Six Web Credibility Types by Age and Weekly Internet Usage*



Credibility Type	Age Group		Internet Usage (hr/wk)	
	Young-Old	Old-Old	0–10	10+
	( <i>n</i> = 15) <i>n</i> (%)	( <i>n</i> = 6) <i>n</i> (%)	( <i>n</i> = 6) <i>n</i> (%)	( <i>n</i> = 15) <i>n</i> (%)
Operator Trustworthiness	15 (100.0)	4 (66.7)	4 (66.7)	15 (100.0)
Operator Expertise	12 (80.0)	3 (50.0)	2 (33.3)	13 (86.7)
Content Trustworthiness	5 (33.3)	3 (50.0)	2 (33.3)	6 (40.0)
Content Expertise	10 (66.7)	1 (16.7)	1 (16.7)	10 (66.7)
Design Trustworthiness	2 (13.3)	0 (0.0)	0 (0.0)	2 (13.3)
Design Expertise	7 (46.7)	2 (33.3)	2 (33.3)	7 (46.7)

### Discussion

The richness of the data collected through semi-structured interviews with older adults and analyzed using the extended typology of web credibility (Choi & Stvilia, 2015) enabled a deeper understanding of this less-studied user group's web credibility assessment of health information. The findings of this study suggest that operator- or author-related cues and heuristics would most affect older adult Internet users' credibility assessments of web-based health information resources, followed by content and design features (Table 1). In addition, age and Internet usage appeared to be potentially important user characteristics to understand the variability in web credibility assessment behaviors among older adult Internet users (Table 2). Participants in the study interpreted the presence of commercial features on a health-related website as a negative cue decreasing the trustworthiness of the site operator. They expected the operator's ultimate goal for running a health-related website to be providing quality health information to the public, rather than selling something. Putting ads on the site or citing sponsored information in an article, for example, led participants to believe that the operator had a profit-seeking intent and therefore, they perceived it as a less trustworthy source of health information. This finding is in line with prior work with older adults (Choi, 2013) and other age groups (Fogg et al., 2001; Fogg et al., 2003; Sillence, Briggs, Fishwick, & Harris, 2004). In their experimental study, Liao and Fu (2014) found that older adults considered the operator's commercial intent to be a negative cue, but they tended to be less effective in recognizing and interpreting commercial features of a website compared to younger adults. This might be due to

the relative lack of Internet experience in the current cohort of older adults, as found in Robertson-Lang et al.'s (2011) study. However, it can also be attributed to the tendency of older adults to lag behind younger people in adopting new technologies, regardless of whether they are familiar and confident with current technologies, due to perceptual, cognitive, and psychomotor declines, as found in past research (Castle et al., 2012; Charness & Boot, 2009; Fisk et al., 2009; Smith, 2014). Furthermore, older adults' belief that nonprofit organizations are more trustworthy than profit-seeking organizations may or may not help them accurately evaluate the credibility of health-related websites, as pointed out by Fogg (2003a). It is thus necessary to educate older adults on identifying and interpreting commercial features on health-related websites and help them develop a healthy skepticism that the alleged nonprofit nature of the sites (e.g., .org sites) does not always guarantee credibility.

The findings from this study also suggest that the perceived expertise of the site operator (or author of an article) is an important criterion for assessing web credibility among older adults. Many participants in the present study turned to reputation or name recognition regarding web-based health information resources to help them assess the credibility of health-related websites. This reputation-based web credibility assessment is different than the aforementioned assumption-based evaluation (e.g., .org sites are for nonprofit organizations and assumed to be more trustworthy than .com sites), because it is based mainly on the participants' first-hand experience with or prior knowledge about a certain source, which might have accumulated even before the Internet era. The reputation-based web credibility assessment strategy has been identified as a prevalent heuristic in the credibility literature, namely the *reputation heuristic* (Metzger et al., 2010) or the *authority heuristic* (Sundar, 2008). A recent study by Unkel and Haas (2017) found that the source's reputation was the most effective factor predicting the probability of people's selection from search engine results. Considering that older adults' expectations about how a system should work are often based on how previous versions (i.e., nonelectronic) were structured (Fisk et al., 2009), *experienced credibility*, which is based on the evaluators' interactions with certain sources over an extended period (Fogg, 2003a), may play a stronger and unique role in older adults' web credibility assessments compared to "born-digital" generations.

Beyond confirming the known effects of a source's reputation or name recognition on people's web credibility assessment, this study reported many participants perceived an operator

or author as a reputable source of health information when they already knew (or believed) that the operator or author is a research-based agent who conducts their own research to provide health information. Furthermore, several participants reported examining whether the agent's (i.e., site operator or author) research was rigorous and done at the group level, as opposed to small and done at the individual level, and whether its research activity occurred during a reasonable period, as opposed to being sporadic or nascent. In other words, the rigor and duration of research by the operator or author appeared to be two important factors determining the perceived expertise of the source among older adults. These findings suggest that service providers should choose sources familiar to older adults, preferably those with good established reputations outside the Internet, to deliver health information more effectively. Also, it is necessary to inform older adults of new online sources of health information, which may not be familiar to older adults but **are** recognized as credible by experts in the given fields.

Although most participants in the present study had trusted sources (e.g., federal research agencies), they often relied on search engines, chiefly Google, to look for health information as well. When the search results linked them to a random page, as opposed to the home page of the site where they could more easily find source-related credibility cues, they evaluated the credibility of the content itself. Given their lack of expertise in medical areas, they regularly cross-checked multiple sources to validate the consistency of the health information. This cross-checking strategy has been found in previous studies (Metzger et al., 2010; Rieh & Hilligoss, 2008; Yi, Stvilia, & Mon, 2012). This type of heuristic evaluation strategy seemed to be useful when operator- or author-related credibility cues do not help or are not handy.

On social media (e.g., Facebook, Instagram), where the operators are frequently not directly in charge of the credibility of individual posts and information about the authors is not always reliable or available (Flanagin & Metzger, 2008; Jessen & Jørgensen, 2012), cross-checking behavior occurs in the form of social validation (Jessen & Jørgensen, 2012) and social annotations (Kulkarni & Chi, 2013). However, none of the older adult Internet users in the present study mentioned social annotations, such as user reviews, as a useful means to evaluate credibility of online health information—this tendency was also found by Liao and Fu (2014). Given that older adults' use of social media is on the rise—37% of older American adults (aged 65 or older) used social media such as Facebook and Instagram in 2018, up from 3% in 2005 (Pew Research Center, 2018b)—future research should investigate why older adults discount

cues from social annotations (e.g., user reviews) when judging the credibility of health information on the web. It is also necessary to study how to motivate them to take advantage of interactive social features of current Internet services (e.g., customer reviews, ratings, questions and answers, “best answer,” “likes,” etc.) as assistive tools to help them judge the credibility of web contents.

Design features, especially the site’s technical stability (e.g., always up and running), did not seem to affect older adults’ web credibility assessments as much as other types of web credibility cues. Design expertise-related factors, mainly usability-related features, were mentioned relatively more often ( $n = 9$ ). **Of note**, younger participants (i.e., young-old adults) and those who used the Internet more hours per week identified more credibility cues and heuristics **related to design features** than their older and less active Internet user counterparts (Table 2). **Specifically, the two participants who mentioned design trustworthiness-related features and seven of the nine who mentioned design expertise-related ones were young-old adults and used the Internet more than 10 hours a week. This finding aligns with findings from past research that age and Internet usage may moderate the effects of design features on people’s web credibility assessments (Fogg et al., 2001; Liao & Fu, 2014). For instance, Liao and Fu (2014) found that the aesthetic and technical design of websites had less significant effects on older adults’ evaluations of online health information than those of younger adults. Several theoretical frameworks also identify technology proficiency as a crucial user characteristic affecting the process and outcome of web credibility assessments (Fogg, 2003b; Lucassen et al., 2013). However, there is a dearth of research on the effects of design elements on older adults’ web credibility assessments, separate from the effects of the operator or author and content. Findings from such research would provide useful insights for web developers to create web interfaces for older adults.**

In addition to practical findings regarding older adults’ evaluations of online health information, the theoretical and methodological contributions of this study to the credibility literature should be noted as well. This study was the first to use the extended typology of web credibility assessment (Choi & Stvilia, 2015), featuring the key dimensions of credibility (i.e., trustworthiness and expertise) and the three major sources of credibility cues (i.e., operator-, content-, and design-related features of web resources). Using the extended typology helped the researcher articulate the conceptual relationships between various credibility cues and heuristics

and the perceived credibility of web-based health information resources in terms of the two underlying dimensions of credibility. This paper demonstrated how the extended framework could guide the analysis and interpretation of qualitative research data such as interview data. More specifically, the definitions of six types of web credibility and example cues and heuristics provided in Table 1 can serve as an initial coding scheme in future qualitative investigations of web credibility assessments. The extended typology, however, must be further validated through empirical data, especially larger-scale quantitative data. An online survey questionnaire should be developed in accordance with the extended typology to test the construct structure of the typology (i.e., the six types) based on empirical data. Once the typology and the instrument are validated, they can be used as knowledge tools to understand how people assess the credibility of various online information topics (e.g., health, education, politics, entertainment, etc.) and media types (e.g., websites in general, social networking sites, social Q&A sites, blogs, etc.).

Although this study generated valuable insights into older adults' credibility assessments of online health information, it has several limitations, mainly related to the research data. First, although the semi-structured interview data were useful to explore the target population's web credibility perceptions and related behaviors, the qualitative nature of the data and small sample size did not allow the researcher to apply inferential statistics to compare the participants' web credibility perceptions by subgroups such as age (i.e., young-old vs. old-old adults) or weekly Internet usage (e.g., 1–10 hours per week vs. 10+ hours per week). Second, a lack of anonymity might have hindered the respondents from providing honest and open responses (Barriball & While, 1994). Third, given that the semi-structured interviews were based on the interviewees' retrospective recall, rather than direct observations, the information collected might be skewed in terms of accuracy (e.g., cues and heuristics mentioned could be limited to most recently used ones).

### **Conclusions**

This study examined older adults' credibility assessments of online health information through semi-structured interviews. The older American adults participating in this study mentioned various types of credibility cues and heuristics they employed to decide whether to accept or reject the health information they found on the Internet. First, they considered indicators of an operator's commercial intent a negative cue that decreased the perceived trustworthiness of the health-related website. Second, they considered the reputation or name

recognition of the operator or author an important cue that increased the expertise of the site. Third, when source-related credibility cues were not available, they attempted to assess the credibility of the content by cross-checking multiple sources. Fourth, poor intrinsic quality in content, such as typos or grammatical errors, decreased the perceived expertise of the content. Fifth, design features, especially technical stability (e.g., always up and running), had a minimal impact on older adults' web credibility assessments. Sixth, usability-related design features were considered important criteria to evaluate the credibility of health-related websites. As shown in Table 2, relatively younger and more frequent Internet users seemed to use more varied types of cues and heuristics in their credibility assessments of online health information than those who were older and less active on the web.

Findings from the present study have both practical and theoretical implications. First, the findings can inform online service developers and intermediaries (e.g., search engines) about how older adults perceive the credibility of online information and how it affects their use of online systems. For example, the findings can be used as a knowledge base in designing, describing, indexing, ranking, and promoting web-based services. In addition, findings can inform educators about how to improve older adults' literacy skills in evaluating the credibility of web-based health information resources, helping them recognize and interpret various credibility cues and heuristics derived not only from traditional source-based characteristics (e.g., name recognition), but also from interactive web-based features such as user-generated content (e.g., user ratings and comments) and design features. Last, this paper sheds light on a more structured way of investigating people's credibility perceptions using the extended framework of web credibility assessment (Choi & Stvilia, 2015). The data analysis and interpretation exercise carried out in this paper demonstrated that various elements of a web interface could be identified as cues and heuristics related to the site's operator (or the article's author), content, and design. In addition, the effects of such cues and heuristics on people's credibility assessments could be articulated by connecting them to the key dimensions of credibility, trustworthiness, and expertise, as opposed to attributing to the abstract concept of credibility.

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