Quality and readability of English-language internet information for adults with hearing impairment and their significant others

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Title

Quality and readability of English-language internet information for adults with hearing impairment and their significant others

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Keywords

hearing impairment, hearing aids, internet health information, health information quality, health information readability

Abstract

Objective: This study evaluated the quality and readability of English-language internet information for adults with hearing impairment and their significant others.

Design: Two keyword pairs (*hearing loss* and *hearing aids*) were entered into five country-specific versions of the most commonly used internet search engine in May 2011.

Sample: For each of the 10 searches, the first 10 relevant websites were included. After removing duplicates, a total of 66 websites were assessed. Their origin (commercial, non-profit organization, or government), date of last update, quality (Health On the Net -HON- certification and DISCERN scores), and readability (Flesch Reading Ease Score, Flesch-Kincaid Grade Level Formula, and Simple Measure Of Gobbledygook) were assessed.

Results: Most websites were of commercial origin and had been updated within the last 18 months. Their quality and readability was highly variable. Only 14% of the websites had HON certification. Websites that were of non-profit organization origin had significantly higher DISCERN scores. Readability measures show that on average, only people with at least 11-12 years of education could read and understand the internet information presented.

Conclusions: Based on these results, this article provides a list of recommendations for website developers and clinicians wishing to incorporate internet information into their practice.

Introduction

People with health conditions and their significant others are increasingly turning to the internet for information. Accessing health information is, after email and search engine use, the third most common internet activity (Fox, 2011). Searching the internet for a significant other's health condition is also common (Fox, 2011). When people face a health decision, the internet is their second most influential source of information after clinician advice (Couper et al, 2010). In a survey of over 8000 Americans, those with a chronic health condition were more likely to search the internet for health information (Bundorf et al, 2006). Furthermore, a stigmatising health condition makes seeking health information on the internet more likely (Berger et al, 2005). Hearing impairment is typically described as a chronic and stigmatising health condition (e.g. Hétu, 1996). It is therefore likely that people commonly search the internet for hearing information. Recent figures on internet searches relating specifically to people with hearing impairment and their significant others are not readily accessible, but it is known that 62% of ear, nose and throat patients are interested in their clinician recommending websites to them (Hunter & Bridger, 2008). Some adults with hearing impairment search the internet before making intervention decisions, such as whether to pursue hearing aids or communication programs (Laplante-Lévesque et al, 2010).

The quality of internet health information has been found to vary greatly (for a systematic review, see Eysenbach et al, 2002). This is a central problem given the prevalence of internet health information searches (Fox, 2011) and the importance people put on the information they access (Couper et al, 2010). Three avenues can address this situation: 1) clients can assess the quality of the internet health information they access; 2) web developers can adhere to voluntary ethical guidelines, and; 3) clinicians and researchers can assess the available internet health information and recommend the best websites to clients. These avenues are briefly described below.

Firstly, clients can assess the quality of the internet health information they access. A systematic review has reported over 250 distinct instruments for clients to assess internet health information (Bernstam et al, 2005). For example, clients can use the 16-item DISCERN quality criteria (Charnock et al, 1999) to determine the quality of health information. However, clients do not always methodically analyse the quality of the health information they access on the internet. They do not systematically read disclaimers or know the authors or owners of the internet websites they visit (Eysenbach & Köhler, 2002). Visual design also influences their information credibility judgements (Robins et al, 2010).

Secondly, to address the problem that clients do not systematically assess health information quality, web developers can adopt voluntary ethical guidelines. Web developers that adhere to ethical guidelines typically display that information as a certification on their relevant websites. In 2001, 98 different website certification schemes were available (Gagliardi & Jadad, 2002). The Health On the Net (HON) Foundation provides one of the many voluntary website certification schemes (Boyer et al, 1998). HON is a Swiss non-profit organization. Its mission is to guide clients and clinicians towards good internet health information. HON proposed its first code of conduct for internet health information in 1996. The current version, available in 35 languages, highlights principles they invite web developers to abide by. As of August 2010, approximately 7300 websites had obtained HON certification. Unfortunately, this represents only a small percentage of all health information available on the internet.

Thirdly, instruments are available for clinicians and researchers to assess the quality of internet information. For example, the *Journal of the American Medical Association* proposed four criteria: 1) authorship; 2) attribution; 3) disclosure, and; 4) currency (i.e. how up-to-date the information is; Silberg et al, 1997). Clinicians and researchers have widely used the DISCERN instrument mentioned above (Charnock et al, 1999) to assess internet health information.

Literacy, or one's ability to read and understand written information, also has clear implications for how clients can use internet health information. A systematic review found that approximately 26% of Americans have low health literacy (Paasche-Orlow et al, 2005). Similar figures have been reported in other industrialized countries (e.g. Australian Bureau of Statistics, 2006; Canadian Council on Learning, 2008). Readability refers to how easy written information is to read and understand. Jargon (for example, in the form of polysyllabic words) and complex linguistic structures (for example, in the form of lengthy sentences) reduce the readability of a text. Many different tests evaluate readability (for a review of their use in health, see Ley & Florio, 1996). Internet health information has been found to have low readability (i.e. to be written above recommended reading level; Walsh & Volsko, 2008). The United States Department of Health and Human Services describes a text with readability above 9 years of education as difficult for many people (Walsh & Volsko, 2008).

As described above, the overall quality and readability of internet health information available has been found to vary greatly. In audiology, it is largely unknown whether the information available on the internet informs or misinforms adults with hearing impairment and their significant others. A systematic review found that clinicians react to clients who seek internet health information in one of three ways: 1) some feel threatened and assert their authority and expertise; 2) some collaborate with the clients to analyse the information, and; 3) some guide the client to good health information (McMullan, 2006). It has been shown that acknowledging the information and the client's information-seeking efforts leads to greater client satisfaction (Bylund et al, 2007). Therefore the first option is not recommended. However, both the second and third avenues can be adequate. To facilitate this collaboration and guidance when audiology clients and their significant others seek internet information, the quality and readability of internet hearing information available needs to be known.

Aim

The aim of this study was to evaluate the information on hearing impairment and its treatment available on the internet. More specifically, the quality and readability of English-language websites as of May 2011 was assessed. Adults and older adults with an acquired hearing impairment and their significant others were the focus of this study.

Methods

Search strategy

At the time the search was conducted (4 May 2011), Google was by far the most commonly used internet search engine. In May 2011, Google controlled 83% of the search engine market (Net Marketshare, 2011). Yahoo (6%), Baidu (5%), and Bing (4%) followed. Therefore this study used the Google search engine.

A panel of 12 people with expertise in audiology from around the world was recruited from the authors' professional contacts. All had extensive professional experience with adults with hearing impairment as clinicians, educators, and/or researchers. They provided 38 keywords they considered adults with hearing impairment and their significant others most likely to use as search terms when looking for information on hearing impairment and its treatment. Clients do not commonly use Boolean operators (e.g. hearing AND problems to search for websites where both words appear) and phrase searches (e.g. "hearing problems" to search for websites where both words appear together; Eysenback & Köhler, 2002). Therefore these were not used in this study. The eight keywords (or keyword pairs) at least two experts identified were entered into Google Trends (www.google.com/trends), which compiles keywords' relative use frequency in Google over time (see Table 1). The first most common keyword, *hearing*, mainly retrieved information pertaining to judicial matters. The second most common keyword, *deaf*, mainly retrieved information relevant for people with a congenital hearing impairment or to the paediatric population. The third and fourth most common keyword pairs retrieved relevant information for adults with hearing impairment and their significant others and were therefore chosen to conduct the searches. The keyword pairs were

hearing loss and *hearing aids*. The search was limited to English-language websites. Google customizes its search engine for countries across the world in an attempt to provide more meaningful search results. Google automatically identifies internet Protocol (IP) addresses and redirects the user to its country-specific search engine. This means that the results of Google searches vary from one country to the other. According to Google Insights for Search (www.google.com/insights/search), in 2010 the keyword pairs *hearing loss* and *hearing aids* were predominantly searched for from American, Australian, British, Canadian, and Indian IP addresses. Therefore the two keyword pairs were entered in five country-specific versions of the Google search engine: Google Australia, Google Canada, Google India, Google United Kingdom, and Google United States of America. Ten separate searches were conducted (2 keyword pairs x 5 country-specific versions of the search engine).

[Insert Table 1 about here.]

Inclusion and exclusion criteria

Websites were included if they provided information regarding hearing impairment and its treatment. Websites that Google identified as ads, news, images, and videos were excluded. Websites that contained information only relevant to people with a congenital hearing impairment or to the paediatric population were excluded. That is because some of the information quality criteria focused on the relevance of information for the target population (see Table 2). Therefore the target population had to be defined to allow for a reliable assessment of information quality. For this study the target clinical population was adults and older adults with an acquired hearing impairment and their significant others. This was a necessary step as the information that is relevant to other populations such as people with a congenital hearing impairment or to children with hearing impairment and their families is different from the information that is relevant to adults and older adults with an acquired hearing impairment and their significant others.

Website origin (commercial, non-profit organization, government, university, or others) was not an inclusion or exclusion criteria. As the vast majority of clients only explore the first few internet search results (Eysenbach & Köhler, 2002), for each search the first 10 websites that met the inclusion criteria were retrieved.

The architecture of each website was scrutinized to make sure all relevant webpages of a given website were assessed. The highest page in the hierarchy (homepage) was the starting point of each assessment. To take a fictitious example, if the webpage "Tips for Managing Tinnitus" of the American Tinnitus Association was a search result (www.ata.org/for-patients/tips), the whole website of the American Tinnitus Association (www.ata.org) was assessed. External content (e.g. imbedded or external links) was not assessed. The primary rater (ALL) recorded each website's origin (commercial, non-profit organization, government, university, or others), author, affiliation, purpose, date of last update, quality (HON certification and DISCERN scores), and readability (Flesch Reading Ease Score, Flesch-Kincaid Grade Level Formula, and SMOG). The quality and readability measures are described in further details below.

Quality assessment

Two measures of quality were used: HON certification and DISCERN scores. HON certification (yes or no) was recorded. Web developers that abide by the eight principles of the HON code of conduct (see Table 3) can apply for HON certification. The list of HON-certified websites is available on the HON website. The HON certification information was retrieved from the HON website. This captured any website which had obtained HON certification, regardless of whether they displayed their HON certification.

The DISCERN has 16 items (see Table 2). Each DISCERN item is rated on a scale from 1 to 5, with higher scores indicative of greater quality. The DISCERN ratings are described as 1: The answer to the item is a

definite no. The quality criterion has not been met at all; 2-4: The answer to the item is partial. The quality criterion has been met to some extent, and; 5: The answer to the item is a definite yes. The quality criterion has been completely met. For each item, the DISCERN handbook provides clear criterion definitions and examples of how rating is done. The DISCERN has good internal consistency and inter-rater agreement (Ademiluyi et al, 2003). The two raters (ALL and KJB) are audiology researchers with clinical audiology qualifications and experience. They read the DISCERN Handbook (Charnock et al, 1999) and discussed it together. They completed the DISCERN on six websites which were not part of this study and discussed discrepancies between their ratings. The primary rater (ALL) scored all websites on the DISCERN. To determine the DISCERN inter-rater agreement, the secondary rater (KJB) rated a randomly selected sub-sample of 23 websites.

[Insert Table 2 about here.]

[Insert Table 3 about here.]

Readability assessment

For each website, three measures of readability were taken: the Flesch Reading Ease Score, Flesch-Kincaid Grade Level Formula, and Simple Measure of Gobbledygook (SMOG). These have been used to assess readability of internet health information before (e.g. Walsh & Volsko, 2008). The Flesch Reading Ease Score (Flesch, 1948) estimates grade reading level based on the average number of sentences and syllables per 100 words. Higher scores indicate higher readability. The Flesch-Kincaid Grade Level Formula translates the 0-100 Flesch Reading Ease Score into an American grade level, estimating the number of years of education required to understand the text. Lower scores indicate higher readability. The Simple Measure Of Gobbledygook (SMOG; McLaughlin, 1969) uses the number of polysyllabic words (words with at least three syllables) to calculate an estimated grade reading level. Similarly to the Flesch-Kincaid Grade Level, lower scores indicate higher readability.

All three readability tests were performed with an online tool (www.online-utility.org/english/readability_test_and_improve.jsp). Some websites contained too much text to include all text in the readability test. Some text could also not easily be retrieved because of its format. Therefore, for each website a text sample that was representative of the overall website's readability was used to measure readability.

Statistical analyses

Data were analysed using Stata version 10.1 (College Station, TX). The following statistical tests were used: chi^2 test, t-test, Pearson's correlation coefficient, and intraclass correlation coefficient. Where relevant, assumptions of normality and equality of variance were tested prior to statistical analysis. An alpha level of .05 was used to determine significance for all statistical analyses. A Bonferroni correction was applied to multiple comparisons.

Results

In total, 100 websites were included (2 keyword pairs x 5 country-specific versions of the search engine x 10 first websites meeting the inclusion criteria). There was some overlap in the different searches' results. Some websites were retrieved by more than one search engine (for example, Google Australia and Google Canada) or were retrieved by both the *hearing loss* and the *hearing aids* keyword pairs. After removing duplicates, 66 websites remained. Websites' author, affiliation, and purpose were recorded where possible. However, this information was often undisclosed. Consequently, it is not reported here. Website origin, data of last update, quality, and readability are summarized in Table 4 and described below.

[Insert Table 4 about here.]

Origin

The websites' origin was recorded: 42 (64%) of the websites were of commercial origin, 14 (21%) were of non-profit organization origin, and 10 (15%) were of government origin (see Figure 1). None of the websites were from a university or of another origin such as a personal website or blog.

[Insert Figure 1 about here.]

Date of last update

As measured in May 2011, most of the websites had been updated within the last 18 months. However, 15 (23%) did not provide information about date of last update (see Figure 2).

[Insert Figure 2 about here.]

Compared to websites from a governmental origin, websites from a commercial origin were significantly more likely to provide no date of last update than to have been updated over 18 months ago ($\chi^2(1) = 7.53$, p=.006).

Quality

HEALTH ON THE NET (HON) CERTIFICATION

Only 9 of the 66 websites (14%) had obtained HON certification. Over half (60%) of the websites from a government origin had HON certification. In contrast, 14% of the websites from a non-profit organization origin and 2% of the website from a commercial origin had HON certification. Websites from a government origin were significantly more likely to have HON certification than websites from a commercial ($\chi^2(1) = 23.02$, p<.001) and from a non-profit organization ($\chi^2(1) = 5.49$, p=.001) origin.

All websites with HON certification displayed their date of last update, confirming this HON requirement. However, websites with HON certification were significantly more likely to have been updated a longer time ago: they were more likely to have been updated 6-18 months ago ($\chi^2(1) = 8.57$, p=.003) or over 18 months ago ($\chi^2(1) = 9.85$, p=.002) than 0-6 months ago.

DISCERN SCORES

For each of the 16 DISCERN items, scores could range from 1 to 5, with higher scores indicative of better quality. Scores for each item are reported in Table 2. When inspecting DISCERN item scores averaged across all 66 websites, Item 3 (*Is it relevant?*) and Item 14 (*Is it clear that there may be more than one possible treatment choice?*) were the two highest scored items (see Table 2). In contrast, Item 1 (*Are the aims clear?*) and Item 2 (*Does it achieve its aims?*) were the two lowest scored items. The following analysis focuses on the total DISCERN scores averaged across all 15 items for each website (DISCERN item 16). The total DISCERN scores were not normally distributed: the scores were positively skewed. A simple transformation (1/(square root)) successfully removed the skewness in the scores. Analyses were therefore completed on the transformed scores but, for ease of interpretation, the original DISCERN scores are reported here. The DISCERN scores varied from 1.13 to 3.93, with a mean of 2.04. Websites from a commercial origin had mean DISCERN scores of 1.88, websites from a government origin, 1.90, and websites from a non-profit organization, 2.64 (see Figure 3). Websites from a non-profit organization origin had higher DISCERN scores than those from a commercial ($t(54) = 4.14$, $p<.001$) or government ($t(22) = 2.91$, p=.008) origin.

A researcher (KJB) independently rated 23 websites on the DISCERN, representing 35% of the full sample of 66 websites. The inter-rater agreement for the DISCERN total scores was high. The intraclass correlation coefficient was .88. This is comparable to an earlier report of inter-rater agreement for the DISCERN total scores where the intraclass correlation coefficient was .82 (Ademiluyi et al, 2003).

[Insert Figure 3 about here.]

Readability

As can be seen in Table 4, the Flesch Reading Ease Score had a mean of 48.26 with a range from 21.42 to 66.88. As mentioned above, the Flesch Reading Ease Score can be translated in the Flesch-Kincaid Grade Level Formula. The Flesch-Kincaid Grade Level Formula had a mean of 11.10 with a range from 7.31 to 17.16. The SMOG had a mean of 12.36 with a range from 8.48 to 17.75. These results show that on average people required at least 11-12 years of education to read and understand the websites. As expected, the three measures of readability were highly correlated. The Flesch-Kincaid Grade Level Formula and SMOG were positively correlated (Pearson's correlation coefficient=.94) whilst the Flesch Reading Ease Score was negatively correlated with the Flesch-Kincaid Grade Level Formula (Pearson's correlation coefficient=-.92) and the SMOG (Pearson's correlation coefficient=-.88). Readability was not significantly associated with website origin, date of last update, or quality (HON certification or DISCERN scores). In other words, readability was independent of all other variables measured.

Summary of quality and readability

Given the amount of dimensions amongst which the websites were assessed, it is difficult to identify the best websites retrieved. Depending on the individual needs of the people searching for internet information, date of last update, quality, or readability could, for example, be more or less important. However, nine websites stood out for their overall quality and readability. These are presented in Table 5. The nine websites rated amongst the top third for quality on the DISCERN scale as well as on all three readability measures. Two of those websites also had HON certification. These are identified in Table 5 with italics.

[Insert Table 5 about here.]

Discussion

This study assessed the quality and readability of 66 websites retrieved when searching the internet for information on hearing impairment and its treatment. Several steps were taken to insure realistic searches. The various country-specific versions of the search engine, the number of websites included and assessed, and the list of variables assessed was also exhaustive. For example, not all similar studies have reported both quality and readability of internet health information (for a review, see Gagliardi & Jadad, 2002). Further, the majority of studies did not use country-specific versions of search engines; thus, their results were less relevant to the whole population of people making English-language internet searches around the world.

Most of the websites assessed were of commercial origin. Websites from hearing aid manufacturers and hearing aid clinics dominated. Over 60% of the websites had been updated within the last 18 months, which suggests up-to-date information. Table 5 lists websites which rated high (amongst the top third) on both measures of quality and readability.

The following section highlights positive features of the websites reviewed in this study. It also provides a list of recommendations for website developers and for clinicians wishing to incorporate internet information into their practice.

Towards internet health information quality

Only a small proportion (14%) of the 66 websites assessed had obtained HON certification. Websites from a government origin were more likely to have received HON certification than websites from a commercial and non-profit organization origin. The average DISCERN scores varied from 1.13 to 3.93 out of 5. Websites from non-profit organization origin had significantly higher DISCERN scores than those from a commercial

or government origin. The HON code of conduct (see Table 3) and the DISCERN scale (see Table 2) provide a good starting point for identifying high quality health information. Seeking certification (e.g. HON) can be a good exercise for website developers to insure health information quality. In terms of the DISCERN, items 1 and 2 obtained the lowest scores. They report the importance of websites formulating simple aims and addressing them effectively. This is something many of the websites assessed could improve on with minimal efforts. DISCERN items 4 and 5 value adequate referencing. Again, this was lacking for many of the websites this study assessed. DISCERN item 7 recommends additional sources of support and information, which many websites addressed with links to other websites. This is a welcome piece of information, but the websites assessed frequently provided links to other websites that were no longer active. Links should be checked and updated on a regular basis.

Many of the websites assessed had features likely to be of great value to adults with hearing impairment and their significant others. For example, hearing impairment simulators, online hearing assessments, descriptions of the role of the different hearing health professionals, comparisons of hearing aid models and features across hearing aid manufacturers, and information specifically designed for significant others can serve as inspiration for website developers. Interactive options such as recent blog posts, live chats, “questions and answers”, or moderated forums are interesting information media which some websites used very successfully. However, some of the websites had important information presented in videos which may not be accessible for all. Offering both text and video with captioning would maximize impact. Some websites also required a log-in or provision of contact details to access some of their sections. Content which requires provision of personal credentials should be avoided.

Towards internet health information readability

The readability of the websites assessed was rather low. The Flesch Reading Ease Score had a mean of 48.26, the Flesch-Kincaid Grade Level Formula, a mean of 11.10, and the SMOG, a mean of 12.36. On

average, only people with at least 11-12 years of education could read and understand the internet information presented. This is higher than the recommended 9 years (Walsh & Volsko, 2008). Unfortunately, exceedingly low readability is not uncommon for health information. For example, the readability of websites on otitis media with effusion (Pothier, 2005) and of patient information on the American Academy of Otolaryngology-Head and Neck Surgery website (Greywoode et al, 2009) was similar to that found in the present study. In contrast, the hearing aid instruction guides used in 12 hearing aid orientation consultations had an average Flesh-Kincaid Grade Level of 7.96 (Nair & Cienkowski, 2010), making them more readable than the websites assessed in the present study. The websites assessed in the present study also had slightly lower readability than 100 other health websites, the later having an average Flesch-Kincaid Grade Level of 9.85 and SMOG of 11.80 (Walsh & Volsko, 2008). Readability measures are widely available (e.g. on the internet or as part of Microsoft Word). For example, the online readability tool used in this study (www.online-utility.org/english/readability_test_and_improve.jsp) allows users to enter a website address. The readability tool returns readability statistics for that website. Clinicians and website developers can easily assess information readability and compare it to published guidelines.

Reducing word and sentence length and avoiding polysyllabic words (words with at least three syllables) dramatically increases readability. For example, breaking down long sentences into several shorter sentences makes a text easier to read and understand. Simplifying vocabulary can also help. Checklists, tables, and “questions and answers” are formats that generally improve the readability of a text. It may appear difficult to reduce word length when using technical terminology. Some might wonder if a compromise between quality and readability is inevitable. However, there was no association between quality and readability in the 66 websites the present study assessed. Table 5 shows that nine of the websites rated amongst the top third for quality on the DISCERN scale as well as on all three readability measures. This highlights how readability can be achieved without compromising quality.

Limitations

Although the search strategy used in the present study was carefully planned, it may differ from how adults with hearing impairment and their significant others search for information on the internet. For example, they may try different keywords which could yield websites with different quality and readability. This study's raters perused each website in detail before assessing its quality and readability. Adults with hearing impairment and their significant others might browse through internet health information in a less systematic manner. This study assessed the quality and readability of internet health information pertaining to hearing. However, it did not assess aspects which contribute to written information accessibility other than readability. For example, visual design, which has been shown to influence perceptions of credibility (Robins et al, 2010), was not assessed. Several aspects of information accessibility are difficult to quantify and highly variable but nonetheless an integral part of internet information accessibility. Table 6 lists aspects of internet information accessibility the Web Accessibility Initiative highlighted. Beyond readability, available guidelines as well as the expertise of web developers are instrumental in designing optimally accessible internet health information.

[Insert Table 6 about here.]

Two quality measures were used (HON and DISCERN). HON certification was chosen because of its long history and its transparent code of conduct. The DISCERN was chosen for its known psychometric properties and its previous use with internet health information. However, both quality measures acknowledge they provide an indication of information completeness rather than information veracity and scientific evidence. Some of the websites surveyed also had certification other than HON. For example, at least one website had obtained GoodNetGuide approval, a for-profit initiative which advertises higher search engine rankings. Those were not considered in this study as part of the quality assessment.

Furthermore, as exemplified in Table 6, readability formulae do not capture all factors contributing to the reading process (Meade & Smith, 1991). Readability scores also vary based on the sample of text assessed for each website. This study attempted to select representative text samples, but the readability results could differ if different text samples had been obtained.

Finally, the intrinsic nature of the internet makes it a highly fluid and changing medium. The results discussed here were valid as of May 2011. It is impossible to know how long the results of this study will remain valid. Investigations of internet health information over time have been conducted in other health areas, indicating quality improvement over time (e.g. Pandolfini & Bonati, 2002). A similar follow-up investigation of information pertaining to hearing impairment and its treatment could be interesting to complete.

Clinical implications

This study highlights how adults with hearing impairment and their significant others might access internet health information with a range of calibre in both quality and readability. Almost half of a sample of over 6000 adults reported wishing their clinicians to be their first source of health information (Hesse et al, 2005). However, 49% of the same sample reported seeking internet health information first, with only 11% going to their clinician first. It is natural that some adults with hearing impairment and their significant others access internet health information prior to seeking professional help. They may raise the internet information they accessed during clinical encounters. As mentioned earlier, previous research shows that collaboration with the clients to analyse the information or client guidance to good health information occur in clinical encounters and lead to greater client satisfaction (Bylund et al, 2007; McMullan, 2006). Those two avenues are discussed below.

Clinicians collaborating with clients to analyse the information benefit from clinicians using some of the quality criteria presented above when discussing internet health information with their clients. It has been shown that evaluating and contextualising the internet health information contributes to client empowerment (Sommerhalder et al, 2009). For example, clinicians can assess whether the advice their clients accessed is relevant. Clinicians can shed light on audiological recommendations and contraindications. They can also comment on services availability (e.g. inform clients if they accessed information from another country which is not relevant to them because of differences in service provision across countries). This can help individualize the information clients retrieve.

Clinicians guiding clients to good health information benefit from the contents of Table 5 and the previous section which provided examples of internet health information with high quality and readability. Further recommended websites relevant for adults with hearing impairment and their significant others are available from the literature, for example regarding tinnitus (Kieran et al, 2010). Web developers should consult these recommended websites when designing and updating websites. Similarly, clinicians can consult recommended websites when selecting internet health information to point to their clients. Clinicians wishing to embrace the internet for intervention purposes can also find inspiring examples of the clinical use of the internet with adults with hearing impairment. For example, a growing number of researchers have studied the use of the internet for hearing rehabilitation (Laplante-Lévesque et al, 2006; Thorén et al, 2011). Overall, a concerted effort is required for people with hearing impairment and their significant others to be informed - rather than misinformed - by the internet.

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Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the article. Some of the nine highest ranked websites (Table 5) are owned by William Demant Holding, which is an employer for two of the four authors. The criteria for websites to appear in Table 5 (top third for quality DISCERN scale and top third for all readability measures) were decided a priori.

References

Ademiluyi G., Rees C.E. & Sheard C.E. 2003. Evaluating the reliability and validity of three tools to assess the quality of health information on the Internet. *Patient Educ Couns, 50*, 151-155.

Australian Bureau of Statistics. 2006. *Health literacy, Australia.* Retrieved September 9, 2011 from http://www.ausstats.abs.gov.au/ausstats/subscriber.nsf/0/73ED158C6B14BB5ECA2574720011AB83/$File/42330_2006.pdf

Berger M.,Wagner T.H., & Baker L.C. 2005. Internet use and stigmatized illness. *Soc Sc Med*, *61*, 1821-1827.

Bernstam E.V., Shelton D.M., Walji M. & Meric-Bernstam F. 2005. Instruments to assess the quality of health information on the World Wide Web: What can our patients actually use? *Int J Med Inform, 74*, 13-19.

Boyer C., Selby M., Scherrer J.R. & Appel R.D. 1998. The Health On the Net code of conduct for medical and health Websites. *Comput Biol Med*, 28, 603-610.

Bundorf M.K., Wagner T.H., Singer S.J. & Baker L.C. 2006. Who searches the Internet for health information? *Health Serv Res*, *41*, 819-836.

Bylund C.L., Gueguen J.A., Sabee C.M., Imes R.S., Li Y. & Aldridge Sanford A. 2007. Provider-patient dialogue about internet health information: An exploration of strategies to improve the provider-patient relationship. *Patient Educ Couns*, *66*, 346-352.

Canadian Council on Learning. 2008. *Health literacy in Canada: A healthy understanding.* Retrieved September 9, 2011 from http://www.ccl-cca.ca/pdfs/HealthLiteracy/HealthLiteracyReportFeb2008E.pdf

Charnock D., Shepperd S., Needham G. & Gann R. 1999. DISCERN: An instrument for judging the quality of written consumer health information on treatment choices. *J Epidemiol Community Health*, *53*, 105-111.

Couper M.P., Singer E., Levin, C.A., Fowler F.J. Jr., Fagerlin A. et al. 2010. Use of the Internet and ratings of information sources for medical decisions: Results from the DECISIONS survey. *Med Decis Making*, *30*(Suppl. 5), 106-114.

Eysenbach G. & Köhler C. 2002. How do consumers search for and appraise health information on the world wide web? Qualitative study using focus groups, usability tests, and in-depth interviews. *BMJ*, *324*, 573-577.

Eysenbach G., Powell J., Kuss O. & Sa E.-R. 2002. Empirical studies assessing the quality of health information for consumers on the World Wide Web: A systematic review. *JAMA*, *287*, 2691-2700.

Flesch R. 1948. A new readability yardstick. *J Appl Psychol, 32*, 221-233.

Fox S. 2011. *Health topics: 80% of internet users look for health information online* (Pew Internet & American Life Project, February 1, 2011). Retrieved September 9, 2011 from http://www.pewinternet.org/~/media//Files/Reports/2011/PIP_HealthTopics.pdf

Gagliardi A., & Jadad A.R. 2002. Examination of instruments used to rate quality of health information on the internet: Chronicle of a voyage with an unclear destination. *BMJ*, *324*, 569-573.

Greywoode J., Bluman E., Spiegel J. & Boon M. 2009. Readability analysis of patient information on the American Academy of Otolaryngology-Head and Neck Surgery website. *Otolaryngol Head Neck Surg*, *141*, 555-558.

Hesse B.W., Nelson D.E., Kreps G.L., Croyle R.T., Arora N.K. et al. 2005. Trust and sources of health information: The impact of the Internet and its implications for health care providers. *Arch Intern Med*, *165*, 2618-2624.

Hétu R. 1996. The stigma attached to hearing impairment. *Scan Audiol*, 25(Suppl. 43), 12-24.

Hunter B.G. & Bridger M.W. 2008. An out-patient study into the suitability of providing Ear, Nose & Throat patients with internet based information. *Internet J Med Inform*, *3*(2).

Kieran S.M., Skinner L.J., Donnelly M. & Smyth D.A. 2010. A critical evaluation of Web sites offering patient information on tinnitus. *ENT - Ear Nose Throat J*, *89*, E11-E14.

Laplante-Lévesque A., Hickson L. & Worrall L. 2010. Factors influencing rehabilitation decisions of adults with acquired hearing impairment. *Int J Audiol*, *49*, 497-507.

Laplante-Lévesque A., Pichora-Fuller M.K. & Gagné J.-P. 2006. Providing an internet-based audiological counselling programme to new hearing aid users: A qualitative study. *Int J Audiol*, *45*, 697-706.

Ley P. & Florio T. 1996. The use of readability formulas in health care. *Psychol Health Med*, *1*, 7-28.

McLaughlin G. H. 1969. SMOG grading: A new readability formula. *J Reading, 12,* 639-646.

McMullan M. 2006. Patients using the Internet to obtain health information: How this affects the patient-health professional relationship. *Patient Educ Couns, 63*, 24-28.

Meade C.D. & Smith C.F. 1991. Readability formulas: Cautions and criteria. *Patient Educ Couns, 17,* 153-158.

Nair E.L. & Cienkowski K.M. 2010. The impact of health literacy on patient understanding of counseling and education materials. *Int J Audiol*, *49*, 71-75.

Net Marketshare 2011. Search Engine Market Share [May 2011].Retrieved September 9, 2011 from http://marketshare.hitslink.com

Paasche-Orlow M.K., Parker R.M., Gazmararian J.A., Nielsen-Bohlman L.T. & Rudd R.R. 2005. The prevalence of limited health literacy. *J Gen Intern Med*, *20*, 175-184.

Pandolfini C. & Bonati M. 2002. Follow up of quality of public oriented health information on the world wide web: Systematic re-evaluation. *BMJ*, *324*, 582-583.

Pothier D.D. 2005. Patients and the internet: Are websites on glue ear readable? *Clin Otolaryngol*, *30*, 566-576.

Robins D., Holmes J. & Stansbury M. 2010. Consumer health information on the web: The relationship of visual design and perceptions of credibility. *J Am Soc Inf Sci Technol*, *61*, 13-29.

Silberg W.M., Lundberg G.D. & Musacchio R.A. 1997. Assessing, controlling, and assuring the quality of medical information on the internet: Caveant lector et viewor—Let the reader and viewer beware. *JAMA*, *277*, 1244-1245.

Sommerhalder K., Abraham A., Zufferey M.C., Barth J. & Abel T. 2009. Internet information and medical consultations: Experiences from patients; and physicians' perspectives. *Patient Educ Couns*, *77*, 266-271.

Thorén E., Svensson M., Törnqvist A., Andersson G., Carlbring P. et al. 2011. Rehabilitative online education versus internet discussion group for hearing aid users: A randomized controlled trial. *J Am Acad Audiol*, *22*, 274-285.

Walsh T.M. & Volsko T.A. 2008. Readability assessment of Internet-based consumer health information. *Respir Care*, *53*, 1310-1315.

Web Accessibility Initiative (WAI). *WAI: Strategies, guidelines, resources to make the Web accessible to people with disabilities.* Retrieved September 9, 2011 from http://www.w3.org/WAI

Table 1. Steps taken to conduct the searches.

A panel of 12 hearing impairment experts identified search terms most likely used by adults with hearing impairment and their significant others when looking for information on the health condition and its treatment. **Keyword survey question** Let's say you are an older adult who is starting to realize hearing difficulties (or you are the partner of this person). You want to find out general information about your problem and its treatment so as a first step you go to Google. What keyword(s) do you try? Feel free to mention as few or as many as you can think of.
The keywords and keyword pairs at least 2 experts mentioned were identified. **Keywords and keyword pairs** Deaf Deafness Hard of hearing Hearing Hearing aids Hearing difficulties Hearing loss Hearing problems
The keywords and keyword pairs identified above were entered in Google Trends to obtain their relative search frequency in 2010, compiled across all countries. The keyword pairs in italics represent those chosen to conduct the searches. **Frequency of keyword use in Google searches according to Google Trends** 1st Hearing 2nd Deaf 3rd *Hearing aids* 4th *Hearing loss* 5th Deafness 6th Hard of hearing 7th Hearing problems 8th Hearing difficulties
The two keyword pairs identified above were entered in Google Insights for Search to obtain the countries with highest search frequency in 2010. The top five countries are reported here. **Countries with high search volume for the keywords *hearing loss* and *hearing aids* according to Google Insights for Search** Australia Canada India United Kingdom United States of America
The two keyword pairs were entered into the five country-specific search engines identified above. Ten separate searches were completed. **Searches** (completed on 4 May 2011) Keyword pair *hearing loss* in Google Australia www.google.com.au/search?hl=en&q=hearing+loss&meta=&gl=au Keyword pair *hearing aids* in Google Australia www.google.com.au/search?hl=en&q=hearing+aids&meta=&gl=au Keyword pair *hearing loss* in Google Canada

www.google.ca/search?hl=en&q=hearing+loss&meta=&gl=ca
Keyword pair *hearing aids* in Google Canada
www.google.ca/search?hl=en&q=hearing+aids&meta=&gl=ca
Keyword pair *hearing loss* in Google India
www.google.co.in/search?hl=en&q=hearing+loss&meta=&gl=in
Keyword pair *hearing aids* in Google India
www.google.co.in/search?hl=en&q=hearing+aids&meta=&gl=in
Keyword pair *hearing loss* in Google United Kingdom
www.google.co.uk/search?hl=en&q=hearing+loss&meta=&gl=uk
Keyword pair *hearing aids* in Google United Kingdom
www.google.co.uk/search?hl=en&q=hearing+aids&meta=&gl=uk
Keyword pair *hearing loss* in Google United States of America
www.google.com/search?hl=en&q=hearing+loss&meta=&gl=us
Keyword pair *hearing aids* in Google United States of America
www.google.com/search?hl=en&q=hearing+aids&meta=&gl=us

Table 2. DISCERN quality criteria for consumer health information on treatment choices (Charnock et al, 1999): items and mean and standard deviation in the sample of 66 websites assessed.

Items	**mean (SD)**
1. Are the aims clear?	1.26 (0.66)
2. Does it achieve its aims?	1.24 (0.66)
3. Is it relevant?	2.67 (1.07)
4. Is it clear what sources of information were used to compile the publication (other than the author or producer)?	1.47 (0.96)
5. Is it clear when the information used or reported in the publication was reported?	1.42 (0.95)
6. Is it balanced and unbiased?	2.15 (1.26)
7. Does it provide details of additional sources of support and information?	2.39 (1.48)
8. Does it refer to areas of uncertainty?	1.62 (1.05)
9. Does it describe how each treatment works?	2.55 (1.13)
10. Does it describe the benefits of each treatment?	2.45 (1.06)
11. Does it describe the risks of each treatment?	1.65 (1.00)
12. Does it describe what would happen if no treatment is used?	1.97 (1.20)
13. Does it describe how the treatment choices affect overall quality of life?	1.89 (0.88)
14. Is it clear that there may be more than one possible treatment choice?	3.62 (1.26)
15. Does it provide support for shared decision-making?	2.35 (1.20)
16. Based on the answers to all of the above questions, rate the overall quality of the publication as a source of information about treatment choices.	2.04 (0.65)

Rating of each item

Rating of 1: The answer to the item is a definite no. The quality criterion has not been met at all.
Rating of 2-4: The answer to the item is partially. The quality criterion has been met to some extent.
Rating of 5: The answer to the item is a definite yes. The quality criterion has been completely met.

Table 3. Principles of the Health On the Net (HON) Foundation code of conduct (Boyer et al, 1998).

Authoritative Author qualifications should be indicated.
Complementarity Information should support, not replace, the clinician-client relationship.
Privacy Privacy and confidentiality of visitor's personal data should be respected.
Attribution Sources of published information should be provided along with dates.
Justifiability Claims relating to benefits and performance should be evidence-based.
Transparency Accessible presentation and accurate contact details should be provided.
Financial disclosure Funding sources should be identified.
Advertising policy Advertising should be clearly distinguished from editorial content.

Table 4. Origin, date of last update, quality (DISCERN score and Health On the Net certification), and readability (Flesch Reading Ease Score, Flesch-Kincaid Grade Level Formula, and Simple Measure of Gobledygook) for the 66 websites assessed.

Origin	**n (%)**
Commercial	42 (63.64%)
Non-profit organization	14 (21.21%)
Government	10 (15.15%)
Date of last update	**n (%)**
0-6 months	24 (36.36%)
6-18 months	16 (24.24%)
>18 months	11 (16.67%)
Undated	15 (22.73%)
Quality: DISCERN score	**mean (SD)**
	range
	2.05 (0.64)
	1.13-3.93
Quality: Health On the Net (HON) certification	**n (%)**
Yes	9 (13.64%)
No	57 (86.36%)
Readability: Flesch Reading Ease Score	**mean (SD)**
	range
	48.26 (10.42)
	21.42-66.88
Readability: Flesch-Kincaid Grade Level Formula	**mean (SD)**
	range
	11.10 (2.16)
	7.31-17.16
Readability: Simple Measure of Gobledygook (SMOG)	**mean (SD)**
	range
	12.36 (1.82)
	8.48-17.75

Table 5. Highest ranked websites (top third for quality DISCERN scale and top third for all readability measures). The websites in italics also have HON certification.

Origin: Commercial
www.hiddenhearing.co.uk
www.listenupcanada.com
www.naturalhearing.co.uk
//speechhearingaid.com/speechhearingaid/hearing-aids.html
Origin: Non-profit organization
//chha.ca
//en.wikipedia.org/wiki/Hearing_aid
www.hearingloss.org
www.mayoclinic.com/health/hearing-loss/DS00172
Origin: Government
//nihseniorhealth.gov/hearingloss

Table 6. Aspects of information accessibility that were not assessed in this study. See Web Accessibility Initiative website (www.w3.org/WAI) for more information.

Aspects	Examples
Design	• Font type and size easily readable • Colour combinations provide adequate contrast between fonts and background • Information conveyed with colour also available in another format, for example with text
Ease of navigation	• Minimisation of scrolling • Avoidance of double clicks • Adequate space between selectable areas
Compatibility	• Compatibility with a variety of internet browsers and versions • Provision of text equivalent for every non-text element • Provision of links to required plug-ins and applets

Figure 1. Origin of the 66 websites assessed.

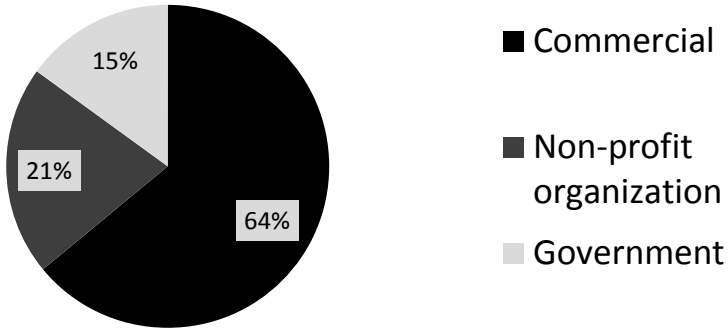


Figure 2. Date of last update of the 66 websites assessed.

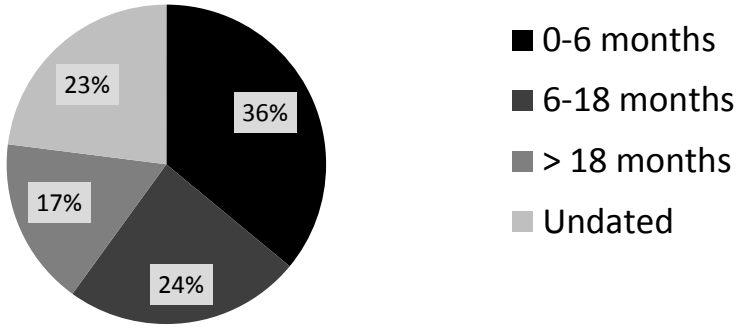
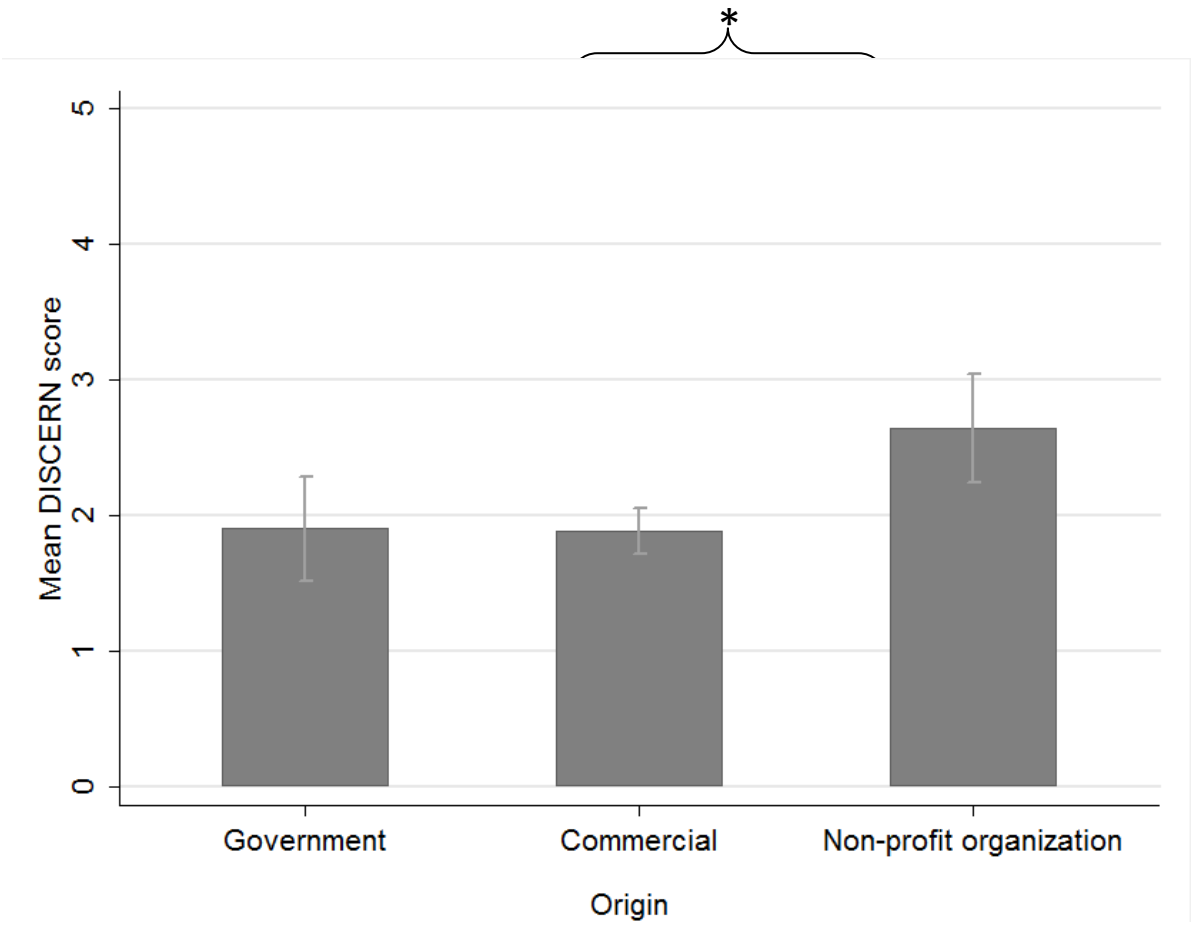


Figure 3. Mean DISCERN score according to website origin (government, commercial, or non-profit organization).



*: p<.01