



“Usability + usefulness = trust”: an exploratory study of Australian health web sites

Study of
Australian
health web sites

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Abstract

Purpose – The aim is to explore users’ reactions to health information web sites from the perspective of trust, retrieval of relevant information and ease-of-use, and to establish the link between perceived quality, trust, and usability.

Design/methodology/approach – An analysis of three Australian health web sites was undertaken. A usability test was conducted on those three web sites resulting in 207 completed user evaluations. The evaluations included both quantitative and qualitative data.

Findings – The three investigated health information web sites do not meet the needs of health consumers. More details such as how information is selected to engender greater trust need to be provided. The retrieval of relevant information could be improved through the implementation of functionality such as spell checking and information differentiation. Finally, ensuring web sites are easy to use contributes to the level of trust users have in a web site.

Research limitations/implications – This was a relatively small study investigating only three generic Australian health web sites, the results however suggest that a larger study looking at other health web sites is needed.

Practical implications – For government agencies developing health information web sites more attention needs to be paid to the design of these web sites if users are to be encouraged to use the web site and return. The research suggests that effective health information web sites must be perceived to be of reliable quality, be trustworthy, have some level of intelligence to assist in the retrieval of relevant information, and be easy to use.

Originality/value – Although there is much research relating to the relationship between web site design and trust for e-commerce transactional web sites this work has not been undertaken for web sites designed for information retrieval, in particular little work has been done of health information web sites. This paper fills in some of the gaps.

Keywords Health services, Information retrieval, Trust, Australia, Online operations

Paper type Research paper



1. Introduction

Internet health information search statistics suggest a growing trend in using the Internet as an information source, at least in the US (Bomba, 2005). Luo and Najdawi (2004) report that 52 million Americans search for health information at least monthly

and 80 per cent of American Internet users have searched for health information (Fox, 2006). Currently there are between 10,000 and 20,000 health related web sites and over 21 million people have been influenced by health information they have retrieved (Sillence *et al.*, 2004). As health spending continues to rise with populations age many governments and medical/health agencies worldwide are using the Internet as a cost-effective way to distribute health information. Delivering Internet-based health information however is not as straightforward as it might seem.

Boyer (2006) makes the point that when people try to make decisions about what health information they should trust, they need to know the standards applied to health information selection and publishing on the web sites, this includes the information source. Health information web sites need to ensure that information is comprehensible, accessible, be of high quality and reviewed by experts (Gustafson *et al.*, 2008; Boyer, 2006).

The research presented in this paper sought to understand users' perception of web site quality, the trust users had in the web site, how easy it is to retrieve relevant information and overall web site usability. The three non-commercial Australian health information web sites were selected to ensure that the users accessed the most relevant locally-focussed information.. We observed users' interactions and response to their search experiences while accessing these web sites. Specifically, our research involved an analysis and usability testing of two Australian government-sponsored health web sites and one other non commercial health web site. The focus on government and non-commercial web sites was made on the assumption that these are less affected by marketing forces and are designed specifically to satisfy users' needs for authoritative, "up-to-date and quality assessed information on important health topics" (Health*Insite*, 2008). We identified factors impacting on the users' perception of quality and effectiveness of web sites, the role usability plays in engendering trust. The aim of our study was to provide insight and recommendations for designing more effective health information web sites.

2. Health information web sites

Health consumers are accessing Internet-based health information for a number of reasons: to educate themselves about health matters, to gather information before visiting a doctor, to get a second opinion, to become more actively involved in decisions relating to their health, lifestyle choices, and to participate in virtual health care activities (Dannecker and Lechner, 2006; Pew/Internet, 2006; Bliemel and Hassanein, 2007).

Australian governments both State and Federal have in recent years have overseen the development of a number of health information web sites providing the public with an authoritative source of information about medical conditions, medications, healthy lifestyles and many other topics related to health. In establishing the Health*Insite* portal the Australian government stated: "Health*Insite* addresses two major deficiencies associated with the increasing tendency of Australian health consumers to source information from the Internet: finding relevant material, and quality assurance" (NIHIMA, 2001). There is limited data on the extent to which Australians search for Internet based health information. In March 2008, Health*Insite* reported that in excess of 330,000 visited the web site (Health*Insite*, 2008).

Health on the Net Foundation (HON) is a not for profit organisation established in 1995 to "promote the effective and reliable use of the new technologies for telemedicine

in healthcare around the world.” (HON, 2006a). Among its activities HON conducts regular research on the use of the Internet for searching for health information, it supports a medical information portal and the HONcode© is one of the most popular quality “seals” (Luo and Najdawi, 2004). In the latest HON survey the four most important features identified for a health web site were: information availability, finding information easily, trustworthiness or credibility and information accuracy. There are many other issues relating to health information web sites. This research evaluates Australian health information web sites in particular the user’s perception of the quality of the information retrieved, the trustworthiness of the web site, usability and usefulness and the relationship between these characteristics.

2.1 Trust and a user’s perception of quality

Trust, particularly in relation to e-commerce transactions, has been dealt with extensively in the literature (Roy *et al.*, 2001; Department of Communication Information and the Arts, 2005; Chen and Barnes, 2007). Trust is, not surprisingly, a significant factor in whether a consumer transacts online. Trust is also an important factor in terms of information retrieval from health web sites (Gummerus *et al.*, 2004; Luo and Najdawi, 2004). Trust for our research is taken to mean, consumers deciding:

[...] whether they trust the accuracy of the information on health web sites, which relates to whether they have confidence in the credibility of the authors of the information and the intentions of the site posting it (Bliemel and Hassanein, 2007).

Luo and Najdawi (2004) argue that there are a range of trust building measures that help engender trust in a health web site. These include “self-regulating policies, source disclosure, ownership disclosure, third-party seals, and branding”. Policies are often used, such as disclosure statements, to provide health consumers with details on how the information has been selected and is related to information quality (Luo and Najdawi, 2004). However, only a small percentage of health information web sites provide information on the source (Pew/Internet, 2006). The HON Survey (2006b) found that among health consumers’ domain name extensions with the greatest credibility were education (.edu) or government organisations (.gov).

While information on quality is provided to health consumers, there is no consistency in the way this is done, making it difficult for health consumers to make a judgement (Luo and Najdawi, 2004). This is of concern given that the quality of Internet content is largely a subjective concept. Acknowledging this, we argue that users are actively engaged in the process of dynamically re-assessing content quality based on their own context. Some web sites provide a quality assessment, but without explicit criteria the user may not have the same level of confidence in the content’s quality, for example, using the HONcode© or code of conduct.

Trust and quality are closely connected (Luo and Najdawi, 2004). We did not, however, seek to evaluate the quality of the content of the information provided through health web sites. This is a very complex issue and there is significant literature covering this area (Huntington *et al.*, 2003; Bomba, 2005). Our concern relates to how users identify and perceive the quality of a health web site and the impact this has on trust.

2.2 Information relevance

A major problem identified with searching the Internet for health information relates to how easy it is for the health consumer to retrieve relevant and accurate information. Often information is inaccurate or even misleading and frequently has not been reviewed by an expert (Fritch, 2003; Zeng *et al.*, 2004). People often do not find the Internet based health information useful (Vermaas and Wijngaert, 2005). Information relevance is most important to health consumers (HON Survey, 2006a, b) yet finding relevant and timely information is often difficult (Childs, 2004). The overwhelming quantity of information a user retrieves is a problem (Christensen and Griffiths, 2000). Information is also often incomplete (HON Survey, 2006a, b), and difficult to read (Sillence *et al.*, 2004).

Poorly organised information sites are also a problem in the health care area. Christensen and Griffiths (2000) note that search engines, whilst helpful in locating masses of relevant information, have a problem with “retrieval precision”. Often users use very simple search strategies when searching for health information, often entering only one or two words (Zeng *et al.*, 2004). This often results in the relevant information if retrieved, listed low on the list of “hits”.

Health web sites should provide functionality enabling information to be found quickly and easily. Luo and Najdawi (2004) describe possible features to support searching; these include health information catalogues, search engines and personalization. Our previous work established a number of technologically possible features that assist search and retrieval of relevant information (Lazarenko & Burstein, 2006). In summary these include:

- *PUSH and PULL features (search and browse)*. PUSH features relate to information that is to be distributed and who should receive it. Features could include portal chats, forums, and other online communication. PULL features relate to active searching.
- *Personalization/categorization of information*. help users identify relevant information more quickly, reducing the quantity of information retrieved and can enable targeting of individual consumers (Luo and Najdawi, 2004; Williams *et al.*, 2002).
- *Differentiation of the types of information*. Not all users want information in the same format, often health consumers prefer information written in layperson terms (Childs, 2004). Differentiation can be provided for example based on specific diseases, drugs and special categories such as patient stories, medical services, medical research for example www.mayoclinic.org/.
- *Spell checking and “sounds like” indexing*. Mis-spelt medical terms impede effective searching.
- *Parsing*. Users who are unfamiliar with medical terminology may have difficulty phrasing appropriate questions hindering the retrieval of relevant information (Williams *et al.*, 2002). Parsing helps with that (Burstein *et al.*, 2006).
- *Ontology and thesaurus*. help users with unfamiliar words and phrases especially when browsing.

- *Metadata*. provides structured information about the content based on some pre-defined schema. Dublin Core is a commonly accepted metadata-schema used for improving information storage and discovery.

These features can have a positive impact on users' perception of health information web sites' usefulness.

2.3 Web site ease of use and perceived usefulness

Although obvious, ease of use is an often overlooked or a poorly managed aspect of web site design. On the other hand, ease of use particularly for finding information is critical to the success of a health web site (Huntington *et al.*, 2003). It is not surprising that studies find "Easy to find information" a very important feature, (Childs, 2004). In one study, 37 per cent of users were unable to find the health information they were looking for (Zeng *et al.*, 2004). Among the factors that Zeng *et al.* (2004) identified as impacting on information retrieval from health web sites were confusing interfaces or poorly organised web sites. There are many factors impacting on web site usability including text design, the display including graphics, navigation, quantity of information and the language used (Fisher *et al.*, 2004a, b). Doshi *et al.* (2003) note that in the case of health web sites related to exercise, tailoring information is important but not generally does not occur. These issues also apply to health information web sites (Williams *et al.*, 2002).

The e-commerce literature argues that there is a strong link between the usability of a web site and users' trust and in particular how useful consumers perceive the web site to be (Roy *et al.*, 2001). In a very recent study Chen and Barnes (2007) found, "Perceived usefulness" was the most important factor in determining trust. These results however, relate to transaction based web sites not web sites facilitating information retrieval. It is important therefore to understand the impact of ease of use of health information web sites where trust is paramount.

3. Research design

Kunst *et al.* (2002) suggest that the Internet has "the potential to facilitate but also to jeopardize health care provision". The questions we sought to answer therefore were:

- How do users perceive the quality of health information web sites?
- What features and functionality are provided on health information web sites to help users search and retrieve relevant information?
- How usable are health information web sites and what is the impact of ineffective sites?
- Does perceived usefulness and ease of use impact on the level of trust a health consumer might have in a health information web site?

Three generic non-commercial, Australian health web sites were used for this research. The sites were selected based on the following criteria:

- *Australian based*. As the research was conducted in Australia it was appropriate to use only Australian based web sites. As noted by Childs (2004), health consumers face some difficulties when accessing information from web sites in

other countries including different health systems, different cultural practices and the use of different terminology.

- Generic health information provided, that is not specific to a disease, age group, etc. This was to ensure the relevance of the task to all users. It could also be argued that generic sites are likely to be accessed by more people than disease specific web sites. Our purpose was to investigate web sites health consumers are most likely to visit.
- *Non commercial.* No commercial web sites were examined in this study because other research indicates that most people will not visit a health web site if it is too commercial (Williams *et al.*, 2002; Huntington *et al.*, 2004).
- *Government sponsored.* The HON Survey (2005) identified that 79 per cent of health consumers preferred a government agency to be responsible for online health information provision.

Only two government sponsored web sites met these criteria; HealthInsite (www.healthInsite.gov.au) and Better Health (www.betterhealth.vic.gov.au). A third web site, Health Network (www.healthnetwork.com.au) was included on the grounds that it was not a commercial health web site and met the other criteria.

3.1 Web site analysis

The first stage of the research involved an examination of each web site for evidence of the items that engender trust as identified by Luo and Najdawi (2004). These were:

- policies describing the principles on which the site is operated including privacy and security, but can include editorial comment on how information is gathered and reviewed;
- disclosure of information sources, that is details of where the information comes from, for example the original publisher, author information, affiliation;
- information on ownership disclosure, that is who owns or manages/sponsors the web site; and
- the use of third-party seals, e.g. HONcode© (Luo and Najdawi, 2004).

Each web site was assessed for the presence or absence of the features and functionality identified in section 2.2.

3.2 Usability instrument and conducting the usability test

The second stage involved a usability evaluation, conducted to assess the effectiveness from the health consumers' perspective of each web site. Usability is "the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use" (Bevan, 2001). The usability instrument was based on an instrument developed and tested previously by one of the authors (Fisher *et al.*, 2004a, b).

The instrument was based on key items identified in the literature as important in web site design for information distribution. Table I briefly describes those items and the literature from which they were derived.

The usability evaluation instrument consisted of Likert scale type statements, questions requiring a response from 1 to 5, questions requiring a yes/no response and

Table I.
Key elements in the
design of web site
information

Information design issue	Literature
Quality of the information and content including how easy it is to read	(Abelse <i>et al.</i> , 1998; Salam <i>et al.</i> , 1998; Bruce, 1999; Becker and Mottay, 2001; Cox and Dale, 2002; Kralisch and Koppen, 2005)
Quantity of information	(Abelse <i>et al.</i> , 1998; White and Manning, 1998; Bruce, 1999)
Appropriateness, accessibility of the text and understanding of the audience	(Nel <i>et al.</i> , 1999; Cox and Dale, 2002; Ceaparu, 2003; Cooper and Reimann, 2003; Cukier and Middleton, 2003)
Design and presentation of the text	(White and Manning, 1998; Becker and Mottay, 2001; Sutcliffe, 2002)
Locating information and navigation	(Fu and Salvendy, 2002; Ceaparu, 2003; Hargittai, 2003; Jenkins <i>et al.</i> , 2003)

open ended questions requiring a free text response. Where questions and statements required a response on a five-point scale, 1 was rated the lowest score and 5 the highest. Trust was measured with the question "Did you trust the information provided on the web site?" and the statement "I felt confident about the reliability and quality of the information provided". A full copy of the instrument can be found WWW (removed for reviewing).

Sixty eight users evaluated each web site resulting in 207 usable evaluations, 32 per cent of participants were female and 68 per cent male. All were third-year undergraduate tertiary students studying human computer interaction, where interface design and understanding and applying usability evaluation instruments were part of the course. The users were of different age groups the majority (79 per cent) were under 25 years of age, 21 per cent were over 25. (Fox, 2006) reports that 79 per cent of Internet users between the age of 18 and 29 have searched the Internet for health information. Although the age group selected for this research is more heavily weighted towards those under the age of 25 it is not an unrealistic target group.

The users had a high level of Internet experience with 91 per cent describing themselves as very experienced. The use of students for usability studies such as this is in line with other studies (Nel *et al.*, 1999; Zhang *et al.*, 2000). Abdinnour-Helm *et al.* (2005) argue that students can be appropriate participants providing they are similar to web users generally and likely to perform the tasks on the web site being investigated, students of this age group are likely to have searched for health information (Fox, 2006).

Task selection is important, the task must represent what a typical user might perform with that web site (Abdinnour-Helm *et al.*, 2005). The task must be manageable, suitable for a laboratory setting and should be something the user can perform (Cordes, 2001). The users were asked to "Think of a health issue that is important to you, a friend or a family member. Using each of the health web sites, search for information on that topic". Students were provided with examples of the type of information they might search for, for example exercise, diet, medication, or a specific health condition. Once the search was completed users completed the questionnaire and reviewed the next site. The questionnaire required both qualitative and quantitative responses. The order of the web sites varied to ensure no web site was accessed exclusively first or last by the evaluators.

The quantitative data were analysed using SPSS. Cross tabulations were conducted using the question and statements and were used to demonstrate “the presence or absence of a relationship” (Bryman and Cramer, 1992, p. 153). A chi-squared test was applied to determine the significance of the results and to establish the strength of the relationship; Pearson’s r was used. Pearson’s r is a measure of a linear association between the variables although there is no definitive “rule” with regard to interpreting the results (Bryman and Cramer, 1992). A factor analysis was conducted to explore the relationship between the identified elements and to assess the degree to which factors such as trust and perception of quality were measuring the same or a similar concept (Bryman and Cramer, 1992).

4. The health web sites

Each web site is described next with evaluators’ comments. Evaluators were asked to describe the best and worst feature of each web site.

4.1 HealthInsite

The Australian government web site HealthInsite “aims to improve the health of Australians by providing easy access to quality information about human health” (www.healthinsite.gov.au/). The Government logo is clearly visible as can be seen in Figure 1.

The web site’s statistics indicate in 2007, the average visits per month exceed 250,000. Information is organised according to topics such as diseases, health and well-being and health services (Figure 1). Some information is provided in other languages. Following are illustrative comments from the participants:

Best feature:

- Navigation was simple and when searching for a health issue the user was given the ability to open a new page.



Figure 1.
HealthInsite web site

- Lots of information - < lots of links.
- Quick Website search + easy links on the left-hand side.
- It informs users whether the hit result has been reviewed by the site or not.

Worst feature:

- Text too small. Background colours are similar, its hard to find the topic directly.
- Having to go through link after link.
- Busy layout, small font, have to read through everything to find what you want.
- Lay out is bad, it's quite hard to find the link to go back to home.

4.2 Better health

The Victorian Government Better Health web site (www.betterhealth.vic.gov.au/) aims to help improve the health and wellbeing of the Victorian community. The web site provides online health and medical information that is:

- Quality assured.
- Reliable.
- Up-to-date.
- Easy to understand.

Although not as obvious as HealthInsite, the Victorian Government logo is displayed as shown in Figure 2.

No information on usage statistics were available. Information is listed under topics such as health information, healthy eating, health interactive and directories (Figure 2). The subjects commented:

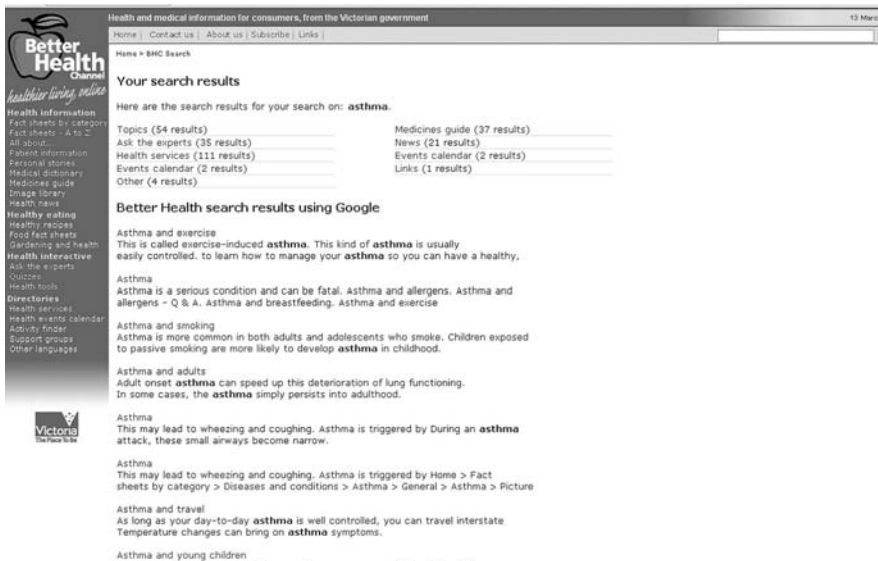


Figure 2.
Better health web site

Best feature:

- The ability to listen to the article.
- The layout, colour, usage of different panels for different sections.
- Has wide range of categories of health information.
- Comprehensive, excellent layout, well structured content.

Worst feature:

- Maybe a little bit too much information on a page.
- Some technical terms used in search page.
- The search results aren't quite logical for me.
- No separation of categorised links they all look like a mass of disorganised links.

4.3 Health network

Health Network is a non commercial health web site described as “a web site about feeling good, looking your best. The focus is on nutrition and diseases and what you can do to take control of both” (www.healthnetwork.com.au/). There are no details displayed altering the user to the authenticity of the web site, as can be seen in Figure 3.

No web site statistics were available. Some of the information topics listed include weight loss, men's and women's health, skin and beauty and diseases. Comments from the participants included:

Best feature:

- The most popular health issues were listed at the side therefore the information could be easily located.
- The design of the site and the way colours are used.
- Easy navigation feature.
- The layout is clear, information easy to find, clearly divided.

Worst feature:

- Not a wide range of info is available.
- Limited searchability.
- Too much information in links.
- Half the screens are left blank and the search does not seem to work well. Not enough topics on screen.

5. Results

The results of the two phases of the research, the web site analysis and usability test conducted are described next.

5.1 Analysis of the content, features and functionality

Each web site was examined for information relating to quality. Table II presents the results

Information relating to quality was difficult to find on all of the web sites. The third-party seal was visible on the home page of Health*Insite* but for Better Health the

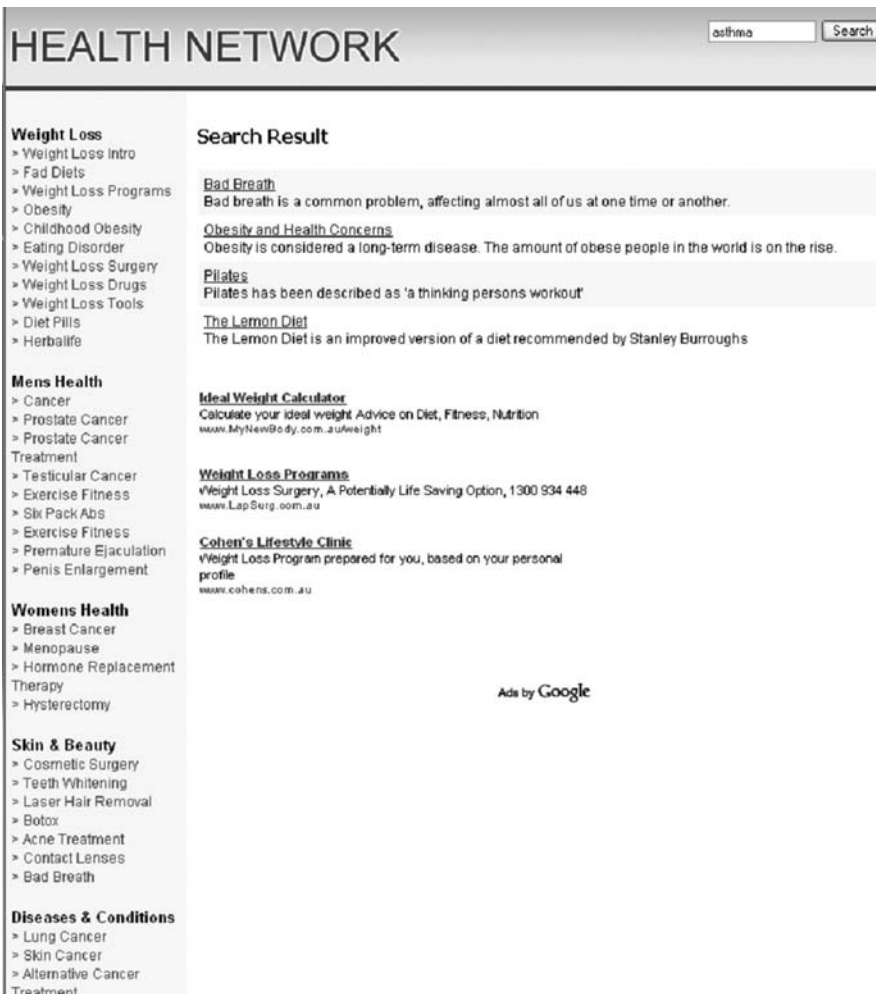


Figure 3.
Health network web site

user needed to look at the Accreditation to find the seal. Both these web sites provided details on how the information they provided was selected. Health*Insite* however, had more detailed information including the editorial board, how they assessed content, publishing standards and information partners.

Qualitative comments from the users confirmed the importance of providing information on the web site's sponsoring organisation and providing information on quality and currency. Comments illustrating this included:

Lack of quality. I believe its content is good, it's approved by the government. Cannot tell if it is a reliable source. Not update date, hard to trust the quality. It's good to see they have a quality assurance page.

Table II.
Information about quality

	Health <i>Insite</i>	Better health	Health network
Policies	Privacy and security statements	Privacy and security statements	No information provided
Disclosure of information sources	Information provided on how information was selected Provided with summary of article information	Information provided on how information was selected Needed to access the item to find the source	No information provided
Ownership disclosure	Yes	Yes	No
Third-party seals	HONcode©	HONcode©	None

Each web site was also examined for the presense or absence of specific features and functionality as presented in section 2.2. The results are summarised in Table III.

Including these features and functionality can improve the overall effectiveness of health web sites. Given that the web sites explored provided very little in terms of features and functionality it is not surprising that users in their comments indicated they had difficulties particularly with spelling medical terms and finding relevant information. Comments illustrating this included:

Exact information required was not found. The information was very brief. But it is was hard to find any more information on the topic. I could not spell Chlamydia. No index or A-Z list. Search did not mention if any or zero results were found. There were only links to topics associated with an issue, a brief summary or sentence regarding the article would have been nice.

5.2 Usability test results

The usability test explored users' reactions to the web sites, their perception of quality and how easily they were able to locate relevant information. Table IV presents the results of questions requiring a yes/no response.

Table IV indicates that 24 per cent of users were unable to find information on the searched for topic, a third (33 per cent) were not satisfied with the amount of information retrieved, and 35 per cent would not return to the web site. Apart from items 7 and 8, Health Network scored the worst on the other seven items.

Table V presents the results of the Likert scale type statements, items 1-12 (1 was strongly disagree to 5 strongly agree) and the question where users were asked to describe their experience using each web site.

Users did not like the graphics or find the interfaces appealing and did not find all the information they wanted. Of the 12 items investigated, Better Health scored 3.9 or higher on six of these items. The statement relating to the confidence users had in the reliability and quality of the information, suggests users preferred Health*Insite*, and Better Health over Health Network. If we assume that a score of 3.5 indicates a positive result then the language used on the web sites, how easy the sites were to use, and text display were rated highly by the users for all the web sites.

Feature/functionality	Presence/absence assessed by	Results
PUSH and PULL	Checked if the portal incorporates PUSH and PULL features	Better Health provides a monthly e-mail newsletter. Users can post questions which experts will respond to. These may later be compiled as fact sheets. <i>HealthInsite</i> offers users the option of saving their personal profile of previous search results and areas of interest. When topics are added to the web site, users are notified via e-mail.
Personalization	Does the portal help to retrieve information relevant to the user? Eg did the portal start an initial dialog to identify user's personal needs?	Better Health provided limited personalization with topics such as Men's health, Pregnancy and birth. <i>HealthInsite</i> search function provided some personalization. Users could specify who the information was for, i.e. child or adult, type of information required. Health Network only offered searching based on gender
Differentiated information access	Analysis of the differentiation of the types of information offered. For example, was there medical, personal, supportive information offered?	Better Health provides personal stories, medical guides and health news. Fact sheets are available organised according to specified categories. <i>HealthInsite</i> provides information in a number of categories including conditions and diseases, health and well-being, fitness, etc. and the option of searching for personal stories. Health Network provided no such features
Search engine	Identify the search engine. Determine if it is internal or external? Searched on the term "Asthma"	All web sites provided a search function. A search for asthma on Health Network resulted in information on bad breath, obesity and the lemon diet, no results related to asthma. The other two web sites returned relevant information
Spell check and "Sounds like index"	Spell checking and "sounds like" indexing tested using misspelt words	Google has spell checking as an internal function however, none of the Australian web sites use Google and none offered any spell checking or help with misspelt words.
Parsing	The sentence "I want to buy tamoxifen" was entered into each web site.	<i>HealthInsite</i> provided three links for the sentence entered, however when tamoxifen itself was searched there were 49 options retrieved. The other two web sites were unable to search on a sentence.

(continued)

Table III.
Functionality and
features identified

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Feature/functionality	Presence/absence assessed by	Results
Ontology and Thesaurus	Checked for an ontology and thesaurus.	Health <i>Insite</i> lists health topics alphabetically, but with no links between related topics. Health Network provides a limited list of categorized topics but no link between categories
Metadata	An examination of source code was made to establish if metadata was used	Better Health and Health <i>Insite</i> use the AGLS metadata schema (Australian Government Locator Schema). Health <i>Insite</i> contains a full description of the publishing policy standards including how metadata should be assigned to the content pages. Health Network makes limited use of metadata

Table III.

Item	Question	Total		Health- <i>insite</i>		Better health		Health network	
		Yes	No	Yes	No	Yes	No	Yes	No
1	Were you able to find information on the topic you wanted information on?	155	48	80	20	85	15	64	36
2	Was enough information on the topic provided?	135	66	72	28	78	22	51	49
3	Would you use this web site again to search for other health information?	131	70	59	41	81	19	56	44
4	Did you trust the information provided on the web site?	165	34	88	12	96	4	68	32
5	Was the information on the web site up to date?	168	26	91	9	95	5	70	30
6	Were you at any stage frustrated using the site?	52	144	33	67	15	85	30	70
7	Were there any aspects of the web site that caused confusion or slowed down your retrieval of information?	64	135	32	68	30	70	20	80
8	Did you get lost at any stage during your exploration of the site?	174	26	21	79	96	4	14	86
9	Was there anything else you wanted to know but could not find out from the site?	55	144	19	81	16	84	47	53

Table IV.
Overview of users' responses to each web site

Note: All figures are percentages

Item	Statement	Mean	Health-insite	Better health	Health network
1	It was easy to navigate through the site	3.75	3.43	4.09	3.7
2	The site was easy to use	3.83	3.6	4.03	3.9
3	The language used was easy to understand	3.92	3.8	3.9	4.0
4	The design of the interface is appealing	3.34	3.2	3.6	3.2
5	The graphics on the site were appealing	3.11	3.1	3.4	2.8
6	The size of the text was easy to read	3.78	3.64	3.94	3.76
7	The text was displayed in a way that was easy to read	3.83	3.62	4.09	3.79
8	All the information I required was on the web site	3.15	3.2	3.5	2.7
9	Number of steps required to get to the information was acceptable	3.44	3.0	3.7	3.5
10	It was easy to find information on the topic that was relevant for me	3.42	3.3	3.8	3.2
11	I understood the terminology used on the web site	3.84	3.9	3.8	3.8
12	I felt confident about the reliability and quality of the information provided	3.69	3.8	4.0	3.2
	Overall how would you describe your experience using this site?	3.06	2.9	3.4	2.8

Table V.
Overview of users' responses to scale questions and statements

5.2.1 Factor analysis. To understand the relationship between the different identified elements a factor analysis on eight of the key variables was undertaken. The analysis indicated that 72 per cent of the variance could be explained by three components. Tables VI and VII present the results.

The factor analysis indicates that factor 1 relates to how appealing the users found the interface, factor 2 relates to the quality of the navigation and how easily information was to find, and Factor 3 relates to the trust users had in the web site.

5.2.2 Cross tabulations. Cross tabulations were conducted to establish those factors that impacted on users' perception of information quality and trust, finding relevant information and ease of use. Only the results of the statistically highly significant cross tabulations ($p < 0.001$) are presented. Based on a data set of 207, a weak correlation is assessed as one where r is between 0.30 and 0.40, and a strong correlation where r is greater than 0.40.

We were particularly interested in what impacts on perceptions of quality, finding information relevant to the user and how easy the web sites are to use:

- (1) Confidence in the reliability and quality of the information provided was influenced by:
 - if users found all the information they required ($r = 0.569$);
 - if users were engaged with the site ($r = 0.513$);
 - if the users found information that was relevant to them ($r = 0.492$);
 - if the number of steps needed to retrieve the information was acceptable to the users ($r = 0.346$);
 - if the users understood the terminology ($r = 0.329$); and
 - if the users found the site easy to use ($r = 0.321$).

INTR 18,5			
	Initial	Extraction	
492	The size of the text was easy to read	1.000	0.419
	The design of the interface is appealing	1.000	0.845
	The graphics on the site were appealing	1.000	0.784
	The number of steps required to get to the information I wanted was acceptable	1.000	0.739
	It was easy to find information on the topic that was relevant for me	1.000	0.745
	It was easy to navigate through the site	1.000	0.526
	Did you trust the information provided on the web site?	1.000	0.847
	I felt confident about the reliability and quality of the information provided	1.000	0.829
Note: Extraction method: principal component analysis			

Table VI.
Factor analysis
communalities

	Component		
	1	2	3
The size of the text was easy to read	0.578		
The design of the interface is appealing	0.898		
The graphics on the site were appealing	0.865		
The number of steps required to get to the information I wanted was acceptable		0.849	
It was easy to find information on the topic that was relevant for me		0.803	
It was easy to navigate through the site		0.622	
Did you trust the information provided on the web site?			0.908
I felt confident about the reliability and quality of the information provided			0.844

Table VII.
Factor analysis rotated
component matrix(a)

Note: Extraction method: principal component analysis. Rotation method: varimax with Kaiser normalization. Rotation converged in five iterations

- (2) Elements that influenced users finding relevant information included:
 - how easy a web site was to use ($r = 0.436$); and
 - how well users understood the terminology used on the web site ($r = 0.312$).
- (3) The factors that impacted on how easy a web site was to use included:
 - the number of steps needed to retrieve the information was acceptable to the users ($r = 0.515$);
 - the appropriateness of the text display ($r = 0.438$);
 - the appropriateness of the size of the text ($r = 0.357$); and
 - users finding the interface appealing ($r = 0.303$).

Users' comments also illustrate the issue they had and how easy they found the site to use. The major problems users encountered included text presentation particularly font size being too small, confusion with the layout and the design, and difficulties with navigation. For example:

- The font is too small to read. Too much information in one page.
- Bad layout. Links too confusing.
- Kind of confusing – especially the layout with different "search results" on the bottom.
- The links were small, so that led to mistakes clicking on them.
- Contrast between text sometimes makes text difficult to read.

5.2.3 Ease of use and trust. Cross tabulations were used to establish the impact web site usability has on trust. The following details the results, all results were highly statistically significant:

- users who were interested or engaged with a web site were more likely to trust the information provided on that web site ($p = 0.000$);
- users who were frustrated in conducting a search were less likely to trust the information on that web site ($p = 0.000$);
- the size of the text ($p = 0.001$), the display of the text ($p = 0.016$) and how appealing users found the interface ($p = 0.007$) also impacted on trust; and
- users who did not find a web site easy-to-use ($p = 0.005$) or found too many steps were required to retrieve information ($p = 0.003$) were more likely to say that they did not trust the information on that web site.

6. Discussion

Usability and willingness to purchase from a web site is frequently discussed in the e-commerce literature (Venkatesh and Agarwal, 2006; Araujo and Araujo, 2003). It is not surprising that consumers are unlikely to purchase from a web site they do not trust and trust is strongly linked to usability. An experiment conducted by Roy *et al.* (2001) examined usability (consisting of the factors ease of navigation, consistency, ease of learning, perception and support) and perceived trustworthiness. Students were asked to complete a task and answer a questionnaire. Roy *et al.* (2001) found that all components of usability except consistency impacted on trust. Our research has established that there is a strong link between users trust of a health information web site and ease of use. In addition in our study most users reported they did not have a good experience, 35 per cent of users would not use these web sites again to search for health information, 17 per cent did not trust the information provided suggesting there are serious design problems. The rest of the discussion is organised around the three areas explored through this research.

6.1 Users' perceptions of quality and trust

Users need information on how quality is determined. Health*Insite* and Better Health subscribe to the HONcode© and both rated more highly than Health Network which does not.

When tested with cross tabulations a number of factors influenced perceptions of quality. Where users were confident about the reliability and quality of a web site they were more likely to return to that site. Factors such as retrieval of relevant information and how easy the site is to use also influence a user's perception of quality. This was supported by the qualitative responses from users. In terms of trust, how engaged users were with the web site, how easy the web site was to use and the overall design of the web site all contributed to greater trust in the web site.

6.2 Improving information retrieval and relevance through features and functionality

The inclusion of features and functionality to help users find relevant information easily was limited despite its availability. The qualitative responses indicate user frustration with spellchecking problems, not being familiar with medical terms and poor search functions. Although all the web sites had a search function, these were often inadequate. Parsing, "sounds like", ontologies and a thesaurus which assist with searching however were lacking, with only one site offered one of these features, parsing. Personalisation and differentiation help users identify relevant information. Better Health and Health*Insite* offered some personalised features and different information access allowing users to "drill down" further to help identify more relevant information. The mean for the question on relevance for Better Health was 3.8, Health*Insite* 3.3 and the mean for Health Network was 3.2, both indicating a less than positive response.

6.3 Ease of use and usefulness

Given the extensive use of the Internet for searching health information, the importance of usability cannot be underestimated. Usability, we have demonstrated impacts, on many aspects including users' confidence in a web site. We found that more attention needs to be paid to how appealing the interface and graphics are and the size of the text. In addition greater consideration needs to be taken to improve information retrieval mechanisms particularly how many steps it takes to retrieve information.

The research indicated that Australian health web sites generally were easy to use, the language was easy to understand and the text was designed appropriately. However, it should be of concern that in the case of two of the web sites more than 40 per cent of users would not use the site again. This suggests that the web sites studied were not very useful.

web sites that are easy to use and easy to navigate resulted in more information being retrieved. Better Health and Health*Insite*, offered users some help with searching and both rated more highly than health network. Health network had very little by way of features or functionality and only offered the opportunity to browse information on a limited list of topics or search for terms.

7. Developing effective health information web sites

The research reported here was exploratory in nature and involved only three Australian health information web sites, however, we believe these results contribute to a better understanding of what is needed to develop effective health information web sites. Although there has been significant research in the area of information quality and Internet-based health information, very little research has focused on the delivery

of health information from the perspective of trust and the perceptions of quality, features and functionality and web site design and usability. Figure 4 describes the three areas investigated, and the design elements that are important for each area. The arrows indicate the factors relating to retrieving relevant information and ease of use impact on users' perception of quality and trust.

The message for those designing health information web sites therefore is, that attention needs to be paid to each of these areas if web sites are to be effective and useful for health consumers.

8. Conclusion limitations and future research

Although this study was limited to investigating three Australian health web sites, the results suggest further research involving health web sites outside Australia is needed to establish, firstly, if other health web sites are different in these areas and secondly to test further the factors we have identified. Further research is also needed to explore other sources of searching for Internet based health information used by health consumers such as search engines.

The authors acknowledge there are other factors likely to impact on the effectiveness of health information web sites including who develops and maintains them. The importance of web sites distributing health information cannot be underestimated it is therefore important that the designers and sponsors of these web sites understand what is important to health consumer to ensure continued use. Our research has demonstrated that users of the web sites studied are likely to have a less than satisfactory experience and many will not return. Users may turn to other health web sites or to non specific search engines such as Google where information reliability and quality is so variable to the point of being dangerous (Kunst *et al.*, 2002). Given the limitations of this research include the use of students and the limited number of web sites investigated. Further research is needed to explore the value users place on the different features and functionality we have identified. We hope through this research to understand what is needed for building better health information web sites.

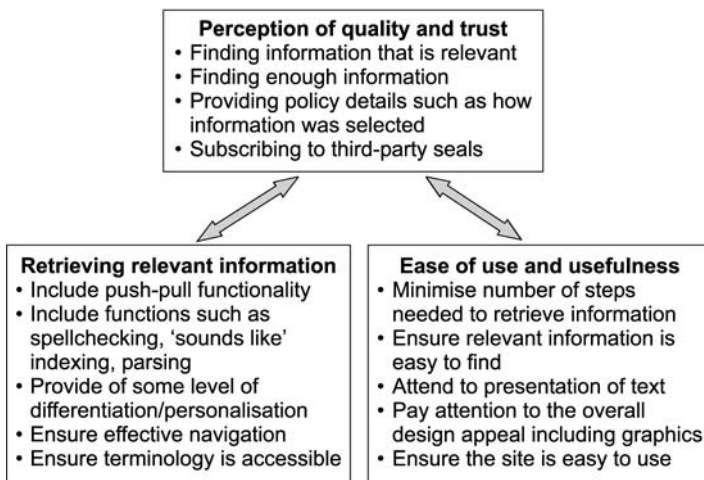


Figure 4.
Factors important in
developing effective health
information web sites

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