An Asian Study of Healthcare Web Portals: Implications for Healthcare Digital Libraries

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Abstract. In contrast to most studies conducted in the West, this study investigated online trust of healthcare Web portals from Asian countries. A Web-based survey was conducted through the Internet for about two weeks and achieved 127 responses. The respondents assessed two healthcare Web portals based on task completion before answering questions in a Web-based questionnaire. Congruent to related studies carried in the West, this study also suggested a significant relationship between usability and perceived credibility of healthcare Web portals. Findings from this pilot study seemed to indicate that the "error prevention" usability heuristic was most severely violated in two healthcare Web portals. The paper then concludes with implications on design of user-centred healthcare digital libraries.

1 Introduction

Emergence of Web portals delivering information, services, products and advertisements to consumers on the Internet has changed the nature of consumer buying. Due to the many advantages of healthcare Web portals, many people are going online to search for healthcare information, products and services (for example, Eastin, 2001; Goldstein, 2000; Young, 2000). More people are surfing the Internet for healthcare and financial information and they are facing important decisions about determining which sites to be trusted (Fogg et al., 2002). Goldstein (2000) defined healthcare Web portals as advertising channels that deliver information, services, products and advertisements to consumers in the Internet. Not only do they provide high standard search capability, they also contain complete information on healthcare, symptoms and diseases that enable consumers and patients to educate themselves anywhere and at anytime of the day.

Besides being excellent advertising tools and information databases, healthcare Web portals could also reduce costs and improve healthcare quality (Young, 2000). There are many kinds of healthcare sites on the Internet. Some serve the general public while some more subject-specific ones serve healthcare professionals or users of particular groups, such as women and children.

In this paper, "Web portal/site" is used to denote single-point-access information systems intended to provide easy and timely access to information and support communities of knowledge workers who share common goals.

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2 Problems Facing Healthcare Portals and Related Studies

However, the quality of healthcare Web portals has become a cause for concern as they vary greatly in terms of accuracy, completeness and consistency, and inaccurate or misleading information can potentially harm Web users (Purcell, Wilson & Delamothe, 2002). For example, Eastin (2001) mentioned that although a large proportion of Internet users in America seek health information online, many of the health information is not provided by medical professionals and there are no government or ethical regulations controlling most of the online information. As a result, many people may be misled and turned away from proper treatment. In addition, Stanford et al. (2002) found that consumers tend to use visual appeal as a marker of credibility so usability may have influenced the perception of credibility of the consumers.

From the study conducted by Eysenbach and Köhler (2002), some respondents expressed that the Internet had allowed them to assess the quality of information more easily because they could verify and cross-check the information with different sites. In general, the respondents favoured the Internet as a source of health information because they could verify and countercheck what the doctors told them. However, they also maintained that they would always confirm the information found online with their doctors (Eysenbach & Köhler, 2002). Therefore, due to the advantages of healthcare web portals, more people are going online for healthcare and medical information, products and services. Determining which site is credible and which one to trust might still be a problem for the general public.

Responding to this concern, a group of researchers from Sliced Bread Design, Consumer WebWatch and Stanford University's Persuasive Technology Lab studied how consumers (general public) determine the credibility of healthcare Web portals, and whether they did it correctly (Stanford et al, 2002). Credibility in the study was defined as "believability and is a perceived quality". The study found that the criteria used by the consumers to evaluate the credibility of healthcare Web portals greatly differed from that of the healthcare professionals. The consumers were relatively influenced more by the overall visual appeal of the sites while the healthcare experts emphasized more on the name reputation of the sites, site operators or affiliates, information source and company motives. Thus, it seems to suggest that in the absence of expertise, the consumers tend to evaluate a site's credibility based on looks and ease of use (Fogg et al., 2002; Stanford et al., 2002).

3 The Study

When one judges the credibility of Web portals, particularly healthcare portals, one would naturally be concerned about factors such as the reputation and authority of the organisation or site owner, seals of approval, accuracy, completeness, currency of the information content, and so on (Eysenbach & Köhler, 2002; Fogg et al. n.d.; Stanford et al., 2002; etc.).

While this study acknowledges the importance of those factors to healthcare portal credibility assessment, the main focus of this study was on Web portal credibility and

usability. In contrast to few studies carried out mostly in the West to evaluate credibility of healthcare portals, this study had three objectives :

- *Objective 1* : To find out important criteria determining perceived credibility;
- *Objective 2* : To determine severity of Nielsen's usability heuristics violated in two well-known healthcare portals; and
- *Objective 3* : To find whether there was a significant relationship between perceived credibility and usability of healthcare Web portals' among Asian consumers, when compared with Western consumers.

Before describing the study, we briefly define two important concepts identified in the objectives used in this study :

1 *Credibility*. It is defined as perceived credibility that does not reside in any object, person or piece of information and is made up of multiple dimensions, based on Fogg and Tseng (1999)'s definition. The "perception" of credibility is believed to be contributed by two key components, namely, trustworthiness and expertise :
   - "Trustworthiness" is defined by terms such as well-intentioned, truthful, unbiased and so on. It is a dimension of credibility that captures the perceived goodness or morality of the source.
   - "Expertise" is referred by terms such as knowledgeable, experienced, competent, and so on. It is also a dimension of credibility but it captures the perceived knowledge and skill of the source.

   As such, the evaluation of credibility will be measured by the overall assessment of the *trustworthiness* and *expertise* dimensions of the Web portal. We believe that since most consumers do not have the medical expertise to assess healthcare Web portals, they would usually judge credibility based on their perceptions of such sites (Fogg et al., 2002; Stanford et al., 2002). In this study, we used "credibility" and "trust" interchangeably in order not to confuse the respondents because it is believed that most lay persons would not distinguish between the two words.
2 *Usability*. Following "ISO 9241-11: Guidance on Usability (1998)", usability is defined as "the extent to which a product can be used by specific users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use" (Bevan, 2001, p. 536), and "ISO/IEC FDIS 9126-1: Software Engineering —Product Quality—Part 1: Quality Model (2000)" defines usability as "the capability of the software product to be understood, learned, used and attractive to the user, when used under specified conditions" (Bevan, 2001, p. 537).

Protocol

The on-line survey was conducted from 3rd to 19th August 2004 for a period of about two weeks, including a three-day extension because one of the respondents who missed the deadline had asked to be allowed to participate. As a result, a few more data were collected after the extension. The potential respondents were invited to respond to the survey through emails. One day after the last day of the survey, a message was put up on the introduction page to inform visitors that the survey collection period had ended.

Profiles of Target Respondents

The target respondents were 15 years old and above, and had not been healthcare professionals or medical students. Since the healthcare Web portals under study were designed for the general public, respondents with strong medical backgrounds were not invited to minimize biases and from the data. The respondents also needed to have at least six months of Internet experience, a duration suggested by a survey carried out by the Health On the Net Foundation ("Health," 2003) to differentiate novice and non-novice Internet users.

Selected Healthcare Web Portals for Evaluation

Initially, four well-known healthcare Web portals were chosen based on rankings of the portals made by both medical professionals and consumers in the Stanford et al (2002) study. The portals were ranked according to perceptions of the credibility and usability of the sites instead of the sites' actual credibility. Since they were U.S. sites rated by residents in the U.S., one would argue there could possibly be some biases. However, Jarvenpaa, Tractinsky and Saarinen (1999) found that cultural differences had little effect on online trust. Moreover, in terms of content, the U.S. based sites used for the study were more or less general in their description of the illnesses. Although they might contain statistical information of U.S. relevance and biases, users should not be affected by such information as they could always check them out at Asia's official Web sites for health statistics. In addition, using healthcare portals that were well-known or that contained logos of authority, such as Ministry of Health, might downplay all other influencing factors as the brand name or logo alone might exert an overpowering influence on the users' judgement.

Survey Instrument Design

The survey form was implemented by an online survey application developed in Active Server Page.NET (ASP.NET) and the data updated into a Microsoft Access database (see http://islab2.sci.ntu.edu.sg/projects/eref/sessurvey/).

A pilot study was carried out to verify survey instrument and estimate the time needed for completion. Two male and two female pilot testers were recruited. On average, each pilot tester took about 40 minutes to complete the online survey, excluding the time taken to jot down the comments and suggestions about the online survey itself. The online survey form was later improved based on feedback from pilot study. They also felt that reducing the number of portals to two or three would reduce the strain on the respondents. Hence, in the actual study, only MDChoice (http://www.mdchoice.com/) and WebMD (http://www.webmd.com/); were used, as MDChoice was supposed to be more usable but less credible than WebMD.

The revised online survey instrument consisted of :

- *Introduction* Page. It informed the respondents about the purpose and running period of the survey, pre-requisites and expectations of the respondents, privacy policy, copyright statement, disclaimer and contact person of the survey. The respondents would click on the "Start" button to go to the "survey" page.
- *Survey Page.* It included the demographic section which asked for respondents' personal particulars as well as criteria used to judge credibility of healthcare portals (Fogg et al., 2002; Stanford et al., 2002).: (i) accuracy

of the information; (ii) name and reputation of the portal; (iii) completeness of the information; (iv) owner or sponsor(s) of the portal; (v) currency of the information; (vi) usability of portal (ease of use, design look, navigability, etc.); (vii) motive of the owner or sponsor(s); and (viii) others.

Respondents were also asked to complete "Task 1" and "Task 2". "Task 1" required the respondents to perform some pre-determined tasks as guidelines to browse the pre-selected healthcare Web portals (see Figure 1). The respondents would click on the links of the Web portals and evaluate the Web portals for their Web site usability and perceived credibility.

After the evaluation, the respondents would continue to "Task 2" to rate the severity of heuristics violated by the healthcare portals based on Nielsen (1994b)'s usability heuristics/criteria (see Figure 2). Each question had an accompanying example to allow the respondents to understand the question better. This survey used a 5-point Likert scale from "-2" (strongly disagree), "-1" (disagree), "0" (neutral), "1" (agree) to "2" (strongly agree) to measure severity of heuristics violated, as suggested by Nielsen (1994a). Negative values were used to give a sense of direction in the choices made by the respondents.

Other pages included :

- *Thank You Page*. After the data was submitted to the database, a "Thank you" Web page was shown to thank the respondents for taking part in the study.
- *Update Error Page*. This page allowed the respondents to continue to submit their data through the email without the need to redo the survey.
- *Survey Form Validation*. Basic checks could be performed on the online survey form after the respondents pressed the "Submit" button to ensure that all the fields were answered.

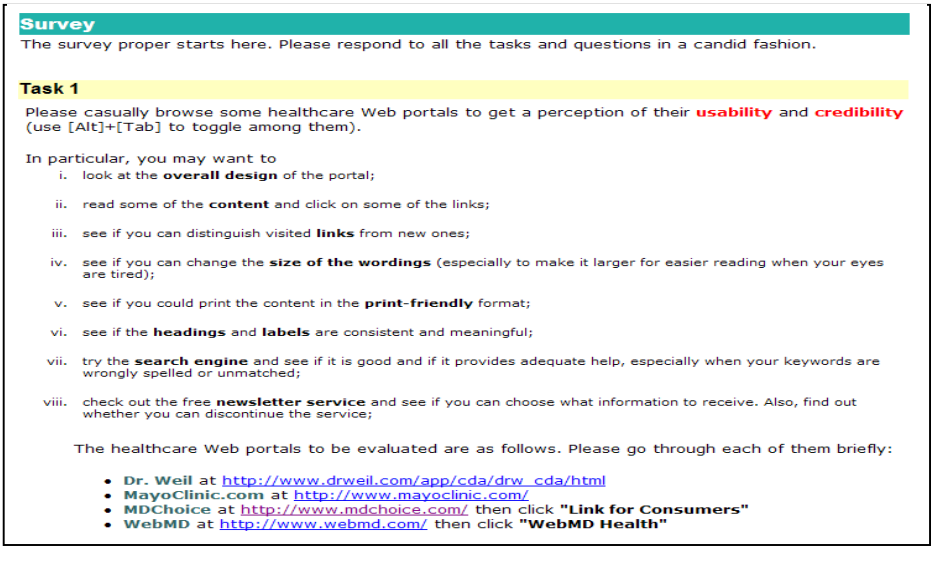

Fig. 1. Web Page Showing Task 1

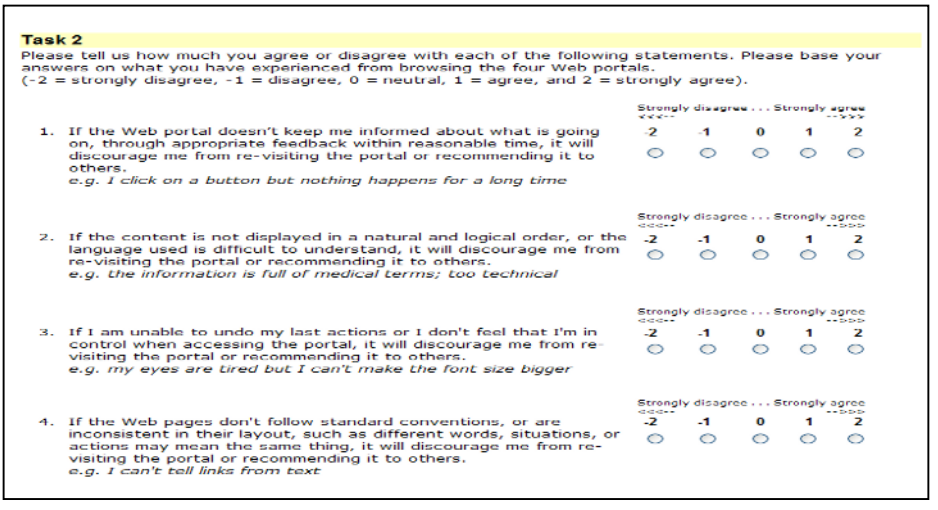

Fig. 2. Web Page Showing Task 2 : Ranking Usability Criteria Based on Nielsen's Heuristics

4 Findings and Analyses

4.1 Profiles of Respondents

There were a total of 133 respondents of which 48% were male and 52% were female. Almost all of the respondents (98%) belonged to the Asia continent except for two who (1%) came from the Australia/Oceania and North America continents, which were not considered in the analyses.

Majority of the respondents were aged between 15 and 34 and very few were from the other age groups. As indicated earlier, most Internet users likely to make use of online healthcare Web portals were from the age group of 15 to 39 years old. Hence, the samples were suitable for the purpose of this study.

Likewise, most of the respondents were university students with the rest made up of students of other educational levels, and members of the general public whose occupation was indicated by "Others". And as stated earlier, university students were representative of the profile of the Internet community who were also most likely to make use of healthcare information online.

4.2 Objective 1: Factors Determining Credibility

"Accuracy of the information" criterion with 133 counts (100%) was the most considered criterion in determining the credibility of the healthcare site, followed by other criteria in the descending order: "Completeness of the information" (70%), "Currency of the information" (68%), "Name and reputation of the portal" (64%) and "Usability of the portal (ease of use, design look, navigability, etc.)" (55%).

The other stated criteria were considered by less than 50% of the 133 respondents. Only 2% of the respondents included other non-stated criteria (as indicated under the

"Others" criterion) such as seal of approvals, corrections, information bias, and so forth as a consideration for Web portal credibility, agreeing with previous studies conducted (Eysenbach & Köhler, 2002; Fogg et al. n.d.; Stanford et al., 2002; etc). Hence, in this study, it seemed that the respondents were most concerned with the accuracy of the information presented in the healthcare Web portals.

Three reliability tests were carried out using Cronbach's alpha to test the reliability of the measurement or scale of the survey with respect to the variables involved. The reliability tests were conducted because Gliem and Gliem (2003) claimed that when one uses Likert-scales, one should use Cronbach's alpha to calculate and report the internal consistency reliability for the scales used in the analysis. Otherwise, the reliability of the items in the scales would be low or unknown. Each of the two two-item scales used in this survey was tested for reliability.

First, the reliability of the two-item scale involving usability and perceived credibility was tested. The reliability alpha of that two-item scale was .80, indicating that the scale has an acceptable and good reliability (Howitt & Cramer, 1999; Sekaran, 1992).

Second, the reliability of the other two-item scale that involved usability and gender was tested. The alpha reliability of that two-item scale was .00, indicating that the scale is not acceptable for reliability (Howitt & Cramer, 1999; Sekaran, 1992). Because of that, another reliability test was done with a three-item scale that involved usability, perceived credibility and gender. The reliability alpha of that three-item scale was only .47, indicating that the scale was also weak and not acceptable for reliability (Howitt & Cramer, 1999; Sekaran, 1992). It was also found that by removing gender from the scale, it would help to improve the reliability to .80, which was the same as that of the first two-item scale. Hence, it seemed that gender was not highly correlated to the other two items in the scale.

4.3 Objective 2: Severity of Usability Heuristics Violation

The data for analysis were provided by Questions 1 to 10 in the Task 2 subsection. It was found that the "Error prevention" (5^{th}) heuristic was most severe when violated because it received the highest count of 133. This finding was in agreement to what Fogg et al. (2000) found in their study. The next in line were the "Visibility of system status" (1^{st}), "Help and documentation" (10^{th}), "Match between system and the real world" (2^{nd}), "Consistency and standards" (4^{th}), "Flexibility and efficiency of use" (7^{th}), "Help users recognize, diagnose, and recover from errors" (9^{th}), "Aesthetic and minimalist design" (8^{th}), "Recognition rather than recall" (6^{th}) and "User control and freedom" (3^{rd}) heuristics.

4.4 Objective 3: Relationship Between Usability and Perceived Credibility

The result of the usability rankings of the two healthcare Web portals shows that WebMD received higher number of counts for rank 1 (57%) than MDChoice (43%). Hence, in terms of usability, WedMD seemed more usable than MDChoice. On the other hand, the perceived credibility rankings of the two healthcare Web portals show that WedMD also received higher number of counts for rank 1 (60%) than MDChoice (40%). Hence, in terms of perceived credibility, WedMD was seen as more credible than MDChoice.

By comparing rankings of the two portals, it is found that WedMD was both more usable and credible than MDChoice. This seemed to contrast with findings from study by Stanford et al. (2002) because the consumers in their study ranked MDChoice better than WedMD. One explanation could be that WebMD had changed and improved its Web site design to become better than that of MDChoice at the time of our study, hence resulting in the difference. Another reason why MDChoice was seen as less credible in this study might be because it was a portal that comprised content of several medical websites assembled by their editorial board (MDchoice.com, Inc., 2000).

To determine the statistical significance of our finding, a Chi-square test of independence and Spearman Correlation were performed to examine the relationship between *usability* and *perceived credibility*. The relationship between these variables was significant, $\chi^2(1, N = 133) = 58.03$, $p < .001$. Likewise, the Spearman correlation also reported that there was a statistically significant positive correlation between *usability* and *perceived credibility*, $r(131) = .661$, $p < 0.01$.

Hence, it seemed that healthcare Web portals that were more usable were perceived to be more credible, hence attracting more visits and re-visits. This result also concurred with some other earlier studies (Eastin, 2001; Eysenbach & Khler, 2002; Fogg et al., 2000).

Yet, only about half of the respondents (55%) indicated that they would look at usability when they assessed the credibility of healthcare Web portals (as obtained from factors affecting credibility). It seemed to suggest that most users would judge the credibility of a healthcare site based on the credibility of the information it provided rather than its usability. It could be that most respondents did not realise they were affected by usability, hence they did not select usability as one of the credibility assessment criteria.

5 Implications for Design of Healthcare Digital Libraries

This study highlighted the top three criteria considered by respondents were "information accuracy", "completeness" and "currency". This finding differed from that of Stanford et al. (2002) study in that the top three criteria considered by the *health experts* were "name reputation and affiliation", "information source" and "company motive", while the top three criteria considered by the *consumers* of that same study were "design look", "information focus" and "information design". The "name reputation of the owner and affiliation", and "design look" (presented by usability) criteria in this study, however, only ranked 5th or 6th respectively, indicating that they were not as important as the accuracy of the information on healthcare sites.

It seemed that health experts in the Stanford et al.(2002) study based more on the source of and organization behind healthcare portals to judge the credibility of the sites, while the consumers based on the ability to make use of or find information on healthcare portals to judge their credibility. On the other hand, this study seemed to indicate that the respondents were more concerned with the credibility of the information presented on healthcare portals, rather than the credibility of the portals themselves or the ability to find the right information.

Nevertheless, the differences might be because the findings from the study of Stanford et al. (2001) were deduced from the comments made by the health experts and consumers (qualitative) but the findings of this study were obtained by asking

respondents questions (quantitative) directly. Or, perhaps it could be that this survey concentrated on information credibility and excluded transactional (sale of products and services) credibility that might have led to the differences.

In objective 2, we looked at usability of the two healthcare sites using Nielsen's heuristics. The respondents were concerned about the design violations detected. Building good, user-centred healthcare portals is a challenge to designers/developers in that "design" of any system is seen as both a science and an art. It is a *science* in that it realises an emphasis towards a principled, systematic approach to the creation and production of a portal. It is an *art* in the creative conceptualisation, expression and communication of the design ideas with a touch of aestheticism for the intended community of audience or users. For portals to satisfy users' needs, they have to be useful and usable. By "usefulness", we mean portals should support users' tasks with a good understanding of models of task completion. "Usability" refers to how information is organized "behind the scenes", and this is especially important in healthcare Web portals where wrong or inaccurate information and services provided could be detrimental.

Results of Objective 3 seemed to confirm previous studies that usability affects users' perception of credibility of healthcare portals. In addition, according to Roberts and Copeland (2001), portals that are ill-defined in their purposes could decrease confidence as a medium for healthcare advice and knowledge. Usability of Web sites seems to be influential to users' faith (or trust) in the information presented in the Web sites or portals, which in turn might affect the credibility of those sites.

Mandel (1997) mentions in one of Nielsen's 1996 findings, based on a user's comment that *"The more well-organized a page is, the more faith I will have in the information."* Gefen and Straub (2003) also advocate that trust, in a broad sense, is the belief that other people will react in predictable ways. This trust is crucial because people need to control, or at least feel that they understand, the social environment in which they live and interact.

In recent years, the distinction between portals and digital libraries is blurring as digital libraries are becoming more sophisticated. Not only are digital libraries just digital collections for specific purposes with powerful search strategies that are clearly defined, they are also becoming single-point-access information portals intended to provide easy and timely access to information and support communities of users who share common goals. Therefore, the issues surrounding credibility and usability of healthcare portals discussed in this paper also apply to digital libraries. Hence, if designers were to build *credible* healthcare portals/digital libraries, they need to ensure that they are *usable*.

6 Conclusion and On-Going Work

This study investigated online trust of healthcare Web portals from Asian countries. Findings from this pilot study seemed to suggest that "error prevention" usability heuristic was most severely violated in these two healthcare Web portals.

Congruent to related studies carried in the West, this study also confirmed there is a significant relationship between usability and perceived credibility of healthcare Web portals.

On-going work involves more studies carried out with more respondents and portals/digital libraries.

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