Web Searching for Health Information:
An Observational Study to Explore Users' Emotions

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Abstract. To-date, most of the research concerning online health information search has focused on how users search the Web and how they evaluate health websites. Despite the concerns raised on the impact of online health information on users, there is little research specifically exploring the problems users encounter and emotions they exhibit during the search process. In this paper, we address this gap by conducting an observational study to understand how users search the Web for health information, the problems they encounter and the emotions they express during the search process. Through eye-tracking, think-aloud and interviews, we examined users' search process holistically. Results showed that users exhibited various negative emotions during the search process especially when there are perceived health risks. Highlighting the theoretical and practical implications of this study, this paper makes recommendations for future research to delve deeper into understanding users' emotions during Web searching for health information.

Keywords: Web Search, Online Health Information, Emotion.

1 Introduction

Currently, searching for health information constitutes an important use of the Web. As per the recent Pew Internet & American Life study, healthcare is high among Web searches [1]. This growing trend has triggered new research directions relating to users' Web searching for health information and has provided challenging opportunities for system developers. Building better systems requires a holistic understanding of how users interact with the Web and the content they find on the Web [2].

In spite of many advantages, studies have reported that online health information significantly impacts users' healthcare decisions such as wrong self-diagnosis [3], engaging in treatment strategies inconsistent with professional recommendations [4] and buying over the counter drugs [5]. A few studies have also raised concerns regarding negative emotions such as increased depression [6] and health anxiety [7, 8, 9] after being exposed to online health information.

Most of the research concerning Web searching for health information has focused on how users search the Web and how they evaluate health websites. Despite the concerns raised on the impact of online health information on general public, there is little research specifically exploring the problems users encounter and emotions they exhibit during the search process. Prior studies in healthcare have shown that negative emotions about health are one of the major causes for users' healthcare decisions

[4, 10]. Thus, it is important to investigate the problems users encounter and the emotions they exhibit during the search process which might have an impact on their healthcare decisions. Hence, the objective of this paper is to understand how users search the Web for health information and to investigate the problems they encounter and the emotions they exhibit during the search process.

2   Observational Study

As a preliminary exploratory study, we conducted an observational study with eight participants (ages 20 to 35; six female and two male) who frequently search the Internet for health information. Mixed methods of data collection, combining observations of participants searching the Web, think-aloud and post-search in-depth interviews were used along with an eye-tracking instrument to capture participants' eye movements while searching for health information. Approval from the Institutional Review Board was taken for conducting the study.

Table 1. Coding themes identified from the transcripts

#	Themes
1	Using Google as search tool
2	Selecting from the results list - Ranking of the results - Description/bold words below the link - Identifying authentic websites
3	Problems encountered - Contradictory results - Information overload - Source not credible - Ranking of the results - Not able to understand medical terminology - Not relevant
4	Emotions expressed - Negative emotions (Anxiety, Worry, Tension, Fear) about health - Positive - Neutral
5	Actions taken (in the past) after searching for online health information - Search repetitively for the problem - Searching for severe illness based on current symptoms - Contact physicians - Go for repetitive tests - Purchase medicine - Wrong self diagnosis

Prior to the observational study, participants were questioned about their perceived health risks if any and their frequently searched health topics. Based on this information, search tasks for each participant were created. During the study, each participant was given a maximum of 10 minutes per task to find an answer that they felt

confident about. No specific search engine or method was prescribed. The entire study session for each participant was transcribed individually and coding themes (Table 1) were deductively constructed from the data.

2.1   Theme 1: Using Google as a Search Tool

As mentioned previously, the participants in the current study literally "Googled" the search tasks. Most of the participants claimed that they always select the websites from Google search results list. One of the male participants who began all of his searches at Google stated: "*I always use Google because I am a layman. Don't understand if I go to .gov websites. Of course, if I want more in depth, then I go to health sites.*" Another female participant while talking about the general search practice, asserted: "*Google, and type whatever I want.*"

When participants landed in health portals filled with too much of text, most of them went back to Google and refined their search terms instead of continuing to read the text from the portals which they were looking at.

2.2   Theme 2: Selecting from the Results List

The second emergent theme concerned with how participants selected from the search results list. Participants most often selected from the first few hits from the first page of Google's search result list. While searching for cure for Alzheimer's disease (search task #3), one of the female participants went to second page in the search result list. When asked about it, she said: "*I normally search from the top links. But in this case, may be because it doesn't have a treatment, the first page talked about how you can prevent it, how to delay it. So I had to go to the second page. Otherwise, I always see the first search results that I find appropriate.*"

Most of the participants went through the short description (especially the bold words) provided below each link. From the list, most of the participants selected websites which according to them was authentic. However, perception of authenticity varied between participants.

The gaze plots obtained from the eye-tracking experiment also showed that participants spent time gazing on the first page of the search results, selected from the top links and also they looked at the description given below the link before selecting it.

It was observed that none of the participants selected the advertisements. It was also observed that some of the participants searched further whenever they found something new. For example, throughout the session, a male participant investigated further whenever he came across with a new disease or a new term associated with the search query. When asked about it, he said that he is interested to know more and he finds the information useful.

Overall, participants did not appear to consider any other quality criteria other than the name of the sources before selecting the websites. Even after selecting the websites, most of the participants did not check the date, author or information quality markers provided in the website. During the interview sessions, all of them said that they generally do not check for the date of the article, author or information quality

markers. However, some of them said they normally check for the date if it was a news paper article and user ratings in the discussion forums.

2.3   Theme 3: Problems Encountered

The third emergent theme identified was problems encountered by the participants while searching for health information. From the screen recording, think-aloud and interview sessions it was observed that participants encountered some of the problems like contradictory results, information overload, source not credible, ranking of the results, not able to understand the medical terminology and irrelevant results while searching online for health information.

Most of the participants complained about not being able to understand the medical terminology used, either due to the technical language used or due to some of the names of the drugs or treatment procedure. A female participant said: "*I don't understand all the drugs. They don't tell you what they do.*"

During the interview session, on asking about problems faced while searching online for health information, a female participant highlighted the problem of irrelevant results by saying: "*The first few results – either they all talk about the same or they all may not have relevant information. It depends on the urgency of the situation.*" Most of the participants felt that information overload is a major problem and it is usually frustrating experience as they would not know which one to pick. Participants also worried about the credibility and relevance of the information provided online.

2.4   Theme 4: Emotions Exhibited

The fourth theme was about the emotions exhibited by participants during the study. All except one participant expressed negative emotions (anxiety, worry, tension and fear) either during the search process or during the post search interview session.

Anxiety towards health was one of the major emotions expressed by the participants during the study. Most of the participants felt that they relate to the disease searched for and felt anxious.

Some of the participants also showed some positive emotions during the study. Knowing more about a disease or a drug gave them awareness. However, in all these cases, these participants did not have perceived health risk of the disease they were searching for. Also, these participants showed negative emotions in other search tasks where they or their family members had perceived health risk. Similarly, a male participant who did not show any negative emotions during the entire study session said that he does not feel any kind of negative emotions because he does not see himself in the potentially risk situations. Hence, whatever information he found was useful for him.

Apart from feeling positive and negative, at certain search tasks, some of the participants said that they did not feel anything, neither positive nor negative. These participants either did not perceive any potential health risk or they already knew the information beforehand. Hence, no emotions were associated with it.

2.5   Theme 5: Actions Taken (in the past) After Searching for Online Health Information

The last emergent theme was about the actions taken by the participants in the past after searching for online health information. Participants were asked to narrate about their past experiences about what they did after searching for health information. Except the two male participants, all others reported that they have searched repetitively for the problem and have searched for serious illness based on the Web searches.

Two female participants recalled their past experience where they had searched online for health information on some specific health problem, and they have contacted their physicians and also have gone for tests to cross verify the information they have found online and also to release the tension. One of the female participants informed that she has purchased medicine after searching online for health information. Another female participant while recalling her past experience on checking for a specific disease, narrated: "*I did self-diagnosis. When I inserted my symptoms into some symptom checker, it gave a list. After reading, I felt this is what I have. At that point, I guessed I had that disease. However, doctors don't really consider it as much of a problem like how I do.*" Explaining further, she said that though she take information from both doctors and Internet, in terms of this specific disease (where she did self-diagnosis), she believed the Internet more.

3   Discussion

The observational study has investigated how users search the Web for health information and their search strategies. In addition, this study has attempted to understand the problems associated with searching online for health information and the emotions expressed by users while searching. The results suggest that search engine is a preferred source for getting health information. All the participants in the observational study used "Google" search engine. This shows that search engine is an interface to health information and a shortcut to health websites. The findings showed that participants were heavily influenced by the order in which the results are presented. In a similar study on the students' use of Google [17], the researchers have examined college students' use of Google through an eye-tracking experiment and found that the students had substantial trust in Google's ability to rank results by their true relevance to the search query. The students in their study consistently selected links in the higher positions even though they were less relevant to the search queries. Though it has been reported that the ranking of the search results is not associated with content quality [10], most of the people believe it to be a measure of relevance. In a study on young adults' usage of online sexual information [2], researchers state that by retrieving results more efficiently than websites' internal search engines and by even providing answers in the search results, Google proves itself to be trustworthy. Similarly, participants in the current study went back to Google, when they either found too much information or did not find the required information in the website selected.

It was observed that participants, from the search result list, most likely selected the websites based on the ranking of the search results, the description given below

each link and their perceived authenticity of the websites. While most of the participants selected the links from the top and checked the description below the link before selecting them, their opinions varied greatly in terms of what constitutes a reliable website.

The gaze plots obtained from the eye-tracking experiment showed that participants selected the results from the top-down approach and they looked at the description given below the link before selecting the link. Past Web search study by Sherman [21] on evaluating search results on Google showed that users' search pattern mimicked an "F" shape, with eyes scanning the top of the page horizontally and then scanning downwards. Nielsen's Alertbox [15] also reports evidence of a dominant F-shaped pattern for eye movements exhibited while people read Web pages in general. Similarly, the current study also showed that participants viewed first few results. Also, for the links lower on the search results page, the words below the link are critical because they easily caught participants' attention while scanning the page.

The findings also showed that though useful, online health information has certain problems like contradictory results, source not credible, scattered results, ranking of the search results and information overload. This finding compliments past studies [24] on the barriers of online health information.

The important finding of the study is the emotions exhibited by the participants – either during the study or while recalling their past experiences on searching online for health information. Negative emotions like "anxiety", "fear", "tension" and "worry" about health were apparent among participants especially when the information they were looking for was about their perceived health risks. As highlighted by the previous studies [26, 29], such negative emotions about health are one of the major causes for users' healthcare decisions. By showing that the participants' exhibit negative emotions while searching for health information, this study has opened up areas for further research in understanding the factors causing such negative emotions.

3.1   Implications and Future Research

The present study is notable in several aspects. By showing that searching online for health information can trigger negative emotions in users especially when they search for their perceived health risks, this study has added to the extant work in Web searching for health information, which has focused mostly on cognitive factors and has largely neglected the role of emotions that can trigger during searching for health information.

By understanding search engine use for health information, this study has implications for the design and evaluation of search engines. The study respondents selected the health websites based on the ranking of the search results. This shows that search engine designers have a responsibility to improve their ranking algorithms so that the ranking of the search results should be associated with quality of health websites. Another contribution of this study is to the HCI community which says the development of information systems and services must take into account users' emotions. Most of the study respondents exhibited negative emotions during the search process. Efforts should be made to reduce such negative emotions by improved search designs

once specific causes of such negative emotions are identified. By showing users elicit emotions during Web searching for health information; this study opens areas for further developments in Web searching for health information to examine how to design a positive search experience for health information seekers.

This paper is a part of ongoing research on investigating users' emotions during Web searching for health information. This study being the first phase of the ongoing research showed that study participants relied heavily on search engines to look for health information and they exhibited negative emotions especially when they were looking for information based on their perceived health risks. Building on these initial results, the factors causing the negative emotions during their Web searching for health information need to be investigated further.

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