Consumer Health Information Searching Process in Real Life Settings

Yan Zhang
School of Information
University of Texas at Austin
Austin, TX, 78701
yanz@ischool.utexas.edu

ABSTRACT
Current research on consumer health information searching focuses on users’ adoption of sources or their behaviors of using a specific system. Yet, few studies take a holistic perspective to examine health information searching as a process that takes place in real life settings and the cognitive activities involved. To fill this gap, we interviewed twenty-one young consumers about their specific health information searching experiences. The results indicated that health information searching is as much social as it is private, as participants not only relied on search engines, but also consulted their close social ties and healthcare providers. When examining information from a source, participants followed a set of heuristics. When evaluating results, they initially focused on making a quick assessment of the relevance of the information, followed by an evaluation of its quality. Participants performed various cognitive activities, including building mental models, testing hypotheses, comparing and validating information, and taking mental notes, to process the information that they found. The knowledge gained from the search had an immediate impact on participants’ health behaviors and health-related decisions.

Keywords
Health information searching, cognitive activities, search process, consumer health informatics.

INTRODUCTION
In recent decades, the healthcare industry has seen a shift from a physician-centered paradigm to a patient-centered paradigm. Under this new paradigm, patients, instead of being passive recipients of services from healthcare providers, are encouraged to play a more active role in preventing diseases, collaborating with providers to make treatment decisions, and managing their own health and diseases (Anderson & Funnell, 2005; Lewise, Chang, & Friedman, 2005). For this role change to be successful, patients must be able to actively seek information, and moreover, effectively process information and make decisions.

A series of Pew studies revealed that consumers have become active health information seekers, with more than 60% of the adults in the U.S. searching online for health information; some also utilized social networking sites and online communities to follow friends’ personal health experience or receive information from peers. The information found online had significant impacts on consumers’ decisions concerning how to treat an illness, how to maintain their health, how to cope with a chronic condition, and whether to see a doctor (Fox, 2011). In response to such high demand and impact, a large number of health websites were created in recent years (Kim & Chang, 2007). Nevertheless, despite the availability of information, consumers were unable to find satisfactory information (Zeng et al., 2004) and were confused and frustrated by their information-searching experiences; in particular, they felt that the search process requires too much effort (Arora et al., 2007).

Researchers have attempted to design better query processing and recommendation mechanisms (Luo, Tang, Yang, & Wei, 2007; White, Dumais, & Teevan, 2008; Zeng et al., 2006), or design novice interfaces, such as faceted search (Mu, Ryu, & Lu, 2011; Kules & Xie, 2011), to support health information searching. These approaches proved to positively impact users’ performance and experience in lab settings. However, both approaches tended to focus on only one aspect of information searching, with the former focusing on query processing and the latter focusing on results presentation.

User experience is a user’s overall experience with a system entailed by every aspect of interacting with the system (Tullis & Albert, 2008). In order to design more effective systems to improve users’ overall experience with health information searching, it is necessary to understand health
information searching as a process from a holistic perspective and in the context that it actually takes place.

Thus, this study intends to explore a group of health information consumers’ information searching process in natural settings. The consumers who participated in the interviews were younger than thirty at the time of the study. This group was chosen because they are active users of the Web and active consumers of health information, as suggested by the most recent Pew study that 71% of the population group aged from 18-29 use the Web for health information, higher than any other age groups (Fox, 2011).

**RELATED LITERATURE**

Numerous studies indicate that young consumers have a high demand for information concerning wellness and healthy lifestyles, particularly exercise, diet, nutrition, alcohol and smoking usage, and sexual health (Baxter, Egbert, & Ho, 2008; Buhì, Daley, Fuhrmann, & Smith, 2009). At the same time, although young people overall enjoy good health many face health problems. For example, the American College Health Association (ACHA) reported that 55.3% of the college students they surveyed were treated for or diagnosed with a specific disease or condition by a health professional in the last 12 months and 25.0% had some form of a chronic condition or disability (ACHA, 2011). Thus, young consumers are also active seekers of information about specific diseases and medical problems, ranging from mild conditions such as allergies, skin problems, and sleeping disorders, to more serious conditions such as diabetes and cancer, as well as prescription medications, treatments, and procedures (Escoffery et al., 2005; Fox, 2011).

When seeking health-related information, human sources were often preferred by these consumers (Fox, 2011). Particularly, studies of college students consistently reported that family and friends were the most frequently used sources, followed by doctors and nurses (Percheski & Hargittai, 2011). In recent years, with a fast development and expansion of its content and nearly universal accessibility, the Web has become a leading source for health information. As previously mentioned, 71% of the 18-29 age group look for health information online (Fox, 2011). This number was higher (about 79%) for those who were college students or have a college-level education (Kwan, et al., 2010; Percheski & Hargittai, 2011). Nevertheless, consumers do not trust the information on the Web as much as they trust human sources (Escoffery et al., 2005). Traditional mass media, such as TV, radio, and magazines, were still being used by young consumers, with more than half reporting receiving health-related information from these media (Kwan, et al., 2010; Percheski & Hargittai, 2011).

Studies also examined consumers’ behavior of using various sources for health information, including strategies and difficulties. In a study that observed sixteen students, between the ages of 19-27, performing four specific assigned search tasks, Efthimiadis (2009) found that over 80% of the participants began their search from a search engine. The second and rather distant starting point was the university’s local resources, mainly its library site. Compared to the elder group in the study, this group had significantly more difficulties answering some questions, as indicated by the fact that they visited a significantly higher number of results. However, overall, they felt easier about planning the searches and more satisfied with their search results, compared to graduate students.

Zhang et al. (2012) observed nineteen students aged from 18-21 performing three exploratory tasks using MedlinePlus, a NLM’s (the National Library of Medicine) consumer health portal. It was found that students were more likely to use the search function and to make transitions between searching and browsing when tasks became more complex. The queries had, on average, 2.5 terms. More than half of the query reformulations focused on adjusting the specificity of query terms along their conceptual hierarchy; that is, making them more general or more specific; and 30% involved replacing one concept in the previous query with a new concept or switching to new concepts altogether. Particularly, students expressed difficulties in exploring relationships between multiple health conditions or concepts.

Most other studies on users’ health information searching behavior focused on cross-sectional consumers, using mainly transaction log analysis (e.g., Spink, et al., 2004; Zeng, et al., 2004) or participant observations (e.g., Eysenbach & Kohler, 2002; Sillence, Briggs, Fishwick, & Harris, 2004; Toms & Latter, 2007). It is a common finding that consumers often begin their search from search engines, rather than medical portals or libraries. The queries were simple and short (less than 3 terms) and often did not match with medical terminologies used to index collections; sometimes, the terms did not properly describe consumers’ actual conditions. Advanced search functions were rarely used. When examining search results, consumers selected first results in search engines and few turned to the second page. Consumers’ information retrieval performance was overall rated as poor. Although they expressed concerns about the credibility and trustworthiness of health-related information, they showed little discretion during the search process.

In addition to behaviors, some studies also examined consumers’ cognitive activities involved in searching for health information. By analyzing transaction logs from a search engine, White and Horvitz (2010) found that many users began their search with common symptoms. As the search moved on, queries escalated to concerns about serious and rare illnesses. They termed this phenomenon as cyberchondria. Cyberchondria could be explained by two human psychological biases: base-rate fallacy (a neglect of total probability of an illness) and availability bias (prediction of the chance of getting an illness based on how easily it is brought to mind).
In another study, by observing twenty cross-sectional participants searching MedlinePlus, Keselman et al. (2008) found that general consumers often had incorrect or imprecise representations of heart diseases. This misunderstanding led them to search irrelevant sites. At the same time, consumers demonstrated confirmation biases in their health information searches, that is, they sought out data to confirm their incorrect initial hypotheses. In general, the health information searching process can be characterized as hypothesis testing. Three search patterns were identified: verifying the primary hypothesis, narrowing search within the general hypothesis, and searching without a hypothesis. The last pattern was also termed bottom-up search and often began with symptoms.

As suggested by the review, as a widespread phenomenon, health information searching has become an important research area. Researchers have examined users’ behaviors and cognitive activities involved in the search process, with the majority focusing on users’ interactions with a particular system, be it a search engine or a health portal, using transaction log analysis. Because of the limitation of the method, the examination of search behaviors was often limited to one search session. Participant observation was also a widely used method. But in the observation studies, users were often asked to perform assigned search tasks rather than searching for their real needs. As a result, there is a lack of understanding of health information searching as a process that takes place in real life settings. In real life, this process could span multiple search sessions and even multiple sources. Correspondingly, the understanding of the cognitive activities involved in the search process was fragmented and lacked cohesion. To fill these gaps, this study presents an initial effort to examine the process of users searching for information to tackle a specific health concern in natural settings. Specifically, we will investigate what sources users use in searching for information to solve a specific health concern, how they examine and evaluate information, and how they process and use the information.

RESEARCH METHODS

Data Collection
Twenty-one undergraduate and graduate students from a major university in Texas were interviewed about their process of seeking information for a particular health concern. These participants were recruited through an email message sent to a campus-wide mailing list. A screening survey was distributed to those who expressed interest in the study to collect demographic information and health information searching incidents. The screening was in place to ensure that those who participated had seriously searched for health information for themselves or for people they cared about.

The interviews were one-on-one and took place in a private lab. All the interviews were conducted from January to April 2012. At the beginning of each session, a brief introduction of the study was given and the participant was then asked to review the consent form. After giving the consent, each participant was asked to fill out a questionnaire about their experience with health information searching and general use of sources for health information. Then, the critical incident interview technique developed by Flanagan (1954) was utilized to gather data about the process of health information seeking. In the interviews, the participant was asked to recall a most recent or most memorable experience of searching for health information and describe the process, sources used, reasons for choosing the sources, strategies of using the sources, as well as the evaluations of the sources. They were also asked to describe the difficulties during the search process, the use of the information found, and the impact of the information on their health-related decision-making. At the end of each interview, the participant was asked to draw a timeline view of the sources that he/she used for the incident. The interviews lasted from 60-90 minutes.

Data Analysis
Users’ demographic information and general use of health information sources were analyzed using descriptive statistics. The interviews were transcribed and analyzed using the qualitative content analysis method (Zhang & Wildemuth, 2009) by following an open coding process (Glaser and Strauss, 1967). Because the focus of this study is students’ health information searching process, a schematic model of information searching that portrays the process as a chronological sequence was adapted to guide the data analysis, as shown in Figure 1 (Savolainen, 2006).

![Figure 1. A schematic process of information searching](image)

The coding was organized by sources. Whenever a source was mentioned by the participant, it was coded. Participants’ strategies of accessing the source, strategies of examining and evaluating the information, as well as
general emotions and cognitions at the time were then associated with the source. For each participant, the sources were organized by the order in which they were used in the searching process. The data analysis was carried out using the Nvivo 9.0 software. A second coder coded 30% of the transcripts and the inter-coder agreement reached 88.2%. In addition, users’ drawings of their information searching process in terms of the use of sources were analyzed to construct information pathways.

RESULTS

Participants and Health Information Sources

Of the twenty-one participants, twelve were females and nine were males. Their ages ranged from 18-28 years old (Mean = 21; S.D. = 2.9). Their experience with searching for health information ranged from 1-10 years (Mean = 4.1; SD = 2.3).

Consistent with findings from previous studies, participants in this study reported using an array of sources for health information. Almost all used parents, friends, healthcare providers, and Google for health information; and more than half used WebMD, Wikipedia, printed materials, and TV programs. About one third have used YouTube. In general, Web 2.0 sources, including online communities, blogs, and generic social networking sites (e.g., Facebook, Twitter), were less favored by the participants, with less than one fourth reporting to have used them. Libraries were the least used source; only two participants reported using libraries for health information. In addition to these common sources, one participant mentioned nutrition labels on food products as an information source.

Characteristics of the Health Information Searching Incidents

The information searching incidents that the participants discussed during the interviews were all motivated by a particular health problem or concern. These problems or concerns could be roughly categorized into the following categories:

- To lose weight or get fit. For example, should I use Creatine to help with my exercise? How do I lose thirty pounds?
- To make decisions about whether to pursue a particular treatment. For example, should I pursue an epidural steroid injection to treat my back injuries?
- To “diagnose” particular symptoms and explore possible treatments. For example, do I have ear infection? Does this symptom suggest herpes? Why does my girlfriend have unusual menstrual bleeding?
- To prevent self from contracting epidemic flu. For example, how to protect myself from contracting swine flu?

It is apparent that these incidents were non-work-related everyday life information searching instances and can be characterized as exploratory tasks. The accomplishment of these tasks tends to require users to gather, differentiate, interpret, evaluate, and sometimes aggregate information from different places. In addition, these tasks were prompted by participants’ immediate health problems or by their genuine interest in the health of someone else; thus, the searches tended to have a comparatively high level of urgency. Nevertheless, it seems highly unlikely that many of the health information needs could be solved in one information-searching session.

Identifying and Using Sources

As shown in Figure 1, once a user recognized an information need and was motivated to fill the knowledge gap or solve the problem, the first step was to identify an information source, be it a human or an information system (Savolainen, 2006; Wilson, 1999). Table 1 lists sources that participants used when trying to solve their health concerns, as well as the sequence in which the sources were referred to.

<table>
<thead>
<tr>
<th>Sources</th>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
<th>5th</th>
<th>6th</th>
</tr>
</thead>
<tbody>
<tr>
<td>Google</td>
<td>7</td>
<td>12</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>WebMD</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parents</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Doctors</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>7</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Friends and relatives</td>
<td>5</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wikipedia</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Blogs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Pamphlets</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mayo Clinic site</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Yahoo! Answers</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A call center</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>An athletic-shoe store</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

Table 1. Use of sources in the information searching process

The table rows list sources that the participants deployed. A variety of sources were used. Web-based sources included Google, WebMD, Mayo Clinic cite, Wikipedia, Yahoo! Answers, and blogs. These sources were accessed directly through the URLs. Sources that participants accessed through search engines results, such as the CDC’s site and CNN site, were not counted as a distinct source because the access to these sources hinged on their appearance in search results. Human sources included parents, healthcare providers (doctors, nurses, and a dietitian), friends, relatives, and coaches. Other sources included a call center, an athletic-shoe store, and pamphlets.

In the information searching process, the participants used, on average, 3.95 sources. The sequence in which the sources were used is indicated in the columns of the table (e.g., 1st refers to the first source that the participants referred to; 2nd refers to the second source that was referred
to, and so on). As shown in the columns, most participants began their search from Google (7), close social ties (parents, friends, and relatives) (9), or WebMD (4). Google was used as the starting point primarily because it was highly familiar to users and easy to access, or because the preferred sources (e.g., parents and doctors) were not available at the time. Close social ties were used as the first place for information because the participants trusted them or because they were perceived to have knowledge of or experience with the condition. Three participants began with WebMD, specifically to use the site’s interactive symptom checker. Only one participant began with his/her doctors.

Among the participants, only two used a single source, Google, to accomplish their tasks; one was to find out whether her BMI was still in a normal range and the other was to find nutrition information for a friend who plays competitive tennis. The remaining participants (90.5%) turned to a second source for information. The participants’ choice of a second source was highly skewed to Google. Particularly, almost all who began with close social ties and WebMD turned to Google. While, among those who began Google (6), two stopped there, one searched Google again, and the rest turned to WebMD, a call center, and Yahoo! Answers, respectively; and the one who began with the doctor turned to a pamphlet about a treatment procedure provided by the doctor.

The majority of the participants (76.2%) went further and consulted a third source, which was more diverse, compared to the second source. Among these participants, some also moved onto a fourth, fifth, or sixth source for their health concerns. At these later steps, the most consulted source was doctors. The fact that doctors tended to appear at the end of the source chains was because many of these search incidents were motivated by symptoms and most of the participants eventually turned to a doctor after a series of searches for diagnoses.

It is obvious that it is very common for the participant to consult multiple sources for a particular health concern. Several reasons for their transitions from one source to the other were identified. First, participants did not find satisfying results from the previous source, as one participant commented:

“I turned to my Marathon running friends because] it did not seem like there was much information, and future information that I would trust, about [my foot pain in Google].”

Second, participants wanted to achieve a better understanding of the problem at hand. Specifically, some expected to learn more about the problem from a new source; some intended to seek different opinions, and others wanted to find the same information from a different source to confirm or validate the information they had found. An example is:

“After [the doctor at the University Health Service] told me poison ivy and this. I tried to search pictures because I never seen a poison ivy, I never had that experience so I didn’t know what it look like, so I just Google that.”

Third, though many preferred doctors as sources; the preferred source was not always accessible at the time the participants needed information. One participant commented that because the earliest appointment he could make with his doctor was three weeks later, he turned to Google to find out what his problem (knee problem) could be. Fourth, participants believed that the new source would provide easy access to the information they wanted. A typical example was Wikipedia. At least three participants mentioned that they always turned to Wikipedia to find about “what is...” questions. The fifth reason for accessing a new source was that the previous source directed the participants to the new source. For example, one participant read through a pamphlet that doctors suggested to her and the other went to the ER doctors upon the suggestion of a doctor in the University Health Service.

Nevertheless, in numerous conditions, visiting a new source was not a planned behavior, but was serendipitous. For example, one participant used a friend as a source because the friend happened to be there when his/her legs acted up. In another case, a participant used pamphlet as a source by chance, as he/she commented: “I went to the SSB [Student Service Building] for something unrelated and they just had one of those pamphlet things.”

Examining and Evaluating Information

In the information searching process, a natural subsequent step to accessing an information source is examining and evaluating information, as shown in Figure 1. Examining information refers to the process of identifying relevant information, and evaluating information refers to users’ appraisal of the information in relation to their problematic situations. These two processes were reported separately.

Examining information

The participants’ use of and interactions with human sources occurred mainly in the form of conversations, through face-to-face communications, phone calls, or texting. Thus, the examination of information mainly refers to users’ examination of digital information, including search engines results and specific websites. Participants’ behavior of examining Google search results could be characterized by the following heuristics:

- Examining top (often the first five) results;
- Quickly skimming both titles and summaries to catch keywords, either search terms or general medical terms closely related to users’ intentions, such as symptoms, side effects, MD, and doctors.
- Not going beyond the first page of the search results.
- Checking more than one page (About 2-4 pages) of results when users were very concerned and
Evaluating information

Evaluating information is a cognitive process that takes place in parallel with examining information. When participants examined search results or webpages by looking at keywords, genre of information, or related information (hot links), they were making an initial attempt to judge the relevance and usefulness of the information, and to decide whether they should spend more time reading the actual content.

Some participants also developed an initial judgment of the trustworthiness of the information in the result examination process. For example, one commented that when examining Google search results, he/she would also look at the URLs to see whether the source was credible. Several participants also judged the trustworthiness of the information based on the look-and-feel of a website. One participant pointed out that “If a website was [in] purple or an odd color, red or yellow, it was come as unprofessional to me and it wouldn’t appeal to me.”

The evaluation of information continued after a source had passed the initial examination and was being read in more detail. At this stage, the evaluation and appraisal focused more on the quality, particularly the credibility and trustworthiness, of the content. This quality judgment was often made based on the author of the information and the responsible intuitions, with some participants also making judgments based on whether the information sounded logical and plausible or whether the information appeared in various sources. At this stage, some participants also evaluated the similarity of information to the situation at hand. One participant admitted that he/she decided to examine a website closely because the descriptions on the site were “very similar” to what he/she was experiencing. Only one participant mentioned checking the currency of information by looking at the copyright date.

The participants also discussed their evaluations of information from human sources. They tended to trust information from parents and friends when they had experienced similar conditions (e.g., leg pain, losing weight), but most of them still referred to the Web for validation. For example, one participant received a positive answer from his coach about using Creatine; but, afterwards, he also conducted a series of searches to find information to help with decision-making. Most participants held doctors as a cognitive authority and trusted their opinions. Only in one case, a participant critiqued a doctor in the University Health Service; the doctor was described as “not very professional” because he was not certain about whether the symptoms were caused by poison ivy.

Processing and Using Information

The process of evaluating information assigns value to information, while the realization of the value requires the information to be processed and used. This section reports two subsequent processes of examining and evaluating information: processing information and using information.

Processing information

Information searching is a process of learning, particularly when users are searching for exploratory tasks (Marchionini, 1997). Thus, processing information is an integral part of information searching. In this study, five major cognitive activities were identified during participants’ searching for health-related information.

Building mental models of a condition or a treatment.

When participants searched for a condition, such as swine flu or an abnormal bleeding, they often tried to build a mental model of the condition by searching for various aspects of the condition, particularly definitions, symptoms, and possible causes. Similarly, when they searched for a treatment or medication to support decision-making, they tried to find various aspects about the treatment, such as dosage, side effects, associated risks, sometimes even how the body works.

Hypothesis testing. When participants had certain symptoms and searched for possible diagnoses, they often formed a hypothesis about what the condition could be before they began the search or during the search process. For example, a participant commented that at the beginning of his/her search for possible causes of the numbness in his/her legs: “Initially I thought it could just be that I was dehydrated. And so I kind of was looking to confirm that, but I didn’t.”

Comparing to find similarities and differences. Two types of comparisons were identified. First, participants reported comparing the information that they found online to their own symptoms to identify similarities and differences. For example, one participant commented: “I first went to look at pictures of specifically herpes or STD’s, looking pictures see you know, compare [to my symptoms].” Second, participants reported looking for different opinions or descriptions concerning a particular condition or diagnosis and comparing those opinions or
descriptions to identify a more plausible one. For example, one participant mentioned comparing possible diagnoses returned by the symptom checker in WebMD.

**Validating.** A couple of participants stopped searching when they had a good enough answer to their questions. For example, after finding a satisfying BMI calculator and calculating her BMI, a participant was satisfied with the result and stopped searching. Most participants, however, after forming an opinion about their conditions or treatment, furthered their searches to validate their opinion. For example, one participant reported that, after receiving a “yes” answer from his coaches concerning whether to use Creatine, he went to Google to search for information about Creatine, particularly side effects. He commented, “I wanted to back them up. I don’t just automatically trust their word without seeing more opinions. You know that one to two to three people’s opinions.”

**Taking mental notes.** Only a few participants mentioned bookmarking or saving useful information that they found during the information searching process to help track or re-find the information, while the rest admitted that they were only taking mental notes. For example, I just wanted to be sure and so […] I would read over [the webpage]; I would be like ‘side effects or this, this and this’, and I would try to pertain it to myself and check yes, check in my head yes, no.

**Using Information**

Using information is a natural extension of processing information. An understanding of how users use the information found is important for understanding health information searching as a process. In this study, the participants reported using the information found in several different ways. First, some participants used the information to reflect on and evaluate their health and health behaviors. For example, one participant commented “I used [the information] to reflect on my habits and my health [and to check] if I was underweight.”

Second, more than half of the participants admitted that they followed the instructions, particularly diet plans and exercise tips, that they found online. For example, one participant who intended to lose weight reported that “[The Google search] told me this and how should I diet and I basically followed what they said and I had this scale so then I can keep track of my weight. […] I just followed what they said.” The other participant suffering from leg pains reported that he followed an instruction (lift the leg and place an ice bag on the joint) from the Web immediately after he read it.

Third, the majority of the participants mentioned sharing information that they found with friends, family, or doctors, either for their information or for discussion purposes. For example, one participant shared the information about symptoms, epidemic information, and prevention means about swine flu that he/she found online with parents. It is worthwhile to note that almost none of the participants shared unprocessed raw information by sending links, sharing webpages, or posting to social networking sites. Rather, they shared information by summarizing what they had found and the sharing often took place over phone calls or through face-to-face communication.

**DISCUSSION**

This study takes a cognitive perspective to understand consumer health information searching as a process in real life settings. To set up a context for this exploration, we examined the participants’ information field for health and wellness-related information. The result suggested that this group was exposed to a wide range of sources, including close social ties, healthcare providers, the Web, and traditional mass media. We also asked the participants to describe a health incident for which they had sought information. These incidents could be categorized into four groups in terms of the goals: to get fit, lose weight, or have a healthier lifestyle; to make decisions about treatment options; to diagnose specific symptoms; and to prevent epidemic diseases.

The participants’ descriptions of their information searching process revealed that users’ health concerns or questions, in most cases, could not be answered by a single encounter with a single source. Instead, the information searching often spanned across multiple search sessions, multiple sources, and lasted for a period of time. Thus, looking through the lens of the conceptual framework of tasks (Byström & Hansen, 2005), searching for information for a specific health concern could be viewed as a work task, and any attempt to use a human or digital source could be viewed as a search task. From the lens of information searching behavior models, searching for a specific health concern could be viewed an instance consisting of multiple information seeking episodes (MISE) (Lin & Belkin, 2000).

The health information searching process and the cognitive activities involved were examined with respect to three major sequential steps in information searching: selecting and accessing information sources, examining and evaluating information, and processing and using information (Savolainen, 2006). In solving specific incidents, all but two participants employed more than one source. All used Google and the majority also used close social ties or healthcare providers, with the former mostly being used at the beginning of the search as a source for exploration, and the latter being used more often at the end of the information pathway as a source to validate opinions developed based on the previous searches.

The participants’ use of sources suggested that this group of consumers is both active and that they are conscious health information seekers. Also, their health information searching was both private and social. The group showed private behavior as they were self-motivated and, in some cases, they were concerned about privacy. The group showed social behavior as they often began searches from...
human sources, particularly parents or relatives, discussed their problems with friends in the intermittent of Web search sessions, or referred to anonymous online communities to look for others’ personal experiences. Apparently, these social and private aspects serve different functions, yet both were needed to enable a satisfying health information searching experience. With the development of the social Web, health information systems should consider means to seamlessly integrate the social aspect of information searching with traditional document searching.

The behavior of examining search results indicated that the participants might follow a set of heuristics, such as examining only top results, quickly skimming titles and summaries, and not going beyond the first page of results. This finding was consistent with previous studies on consumer health information searching (Toms & Latter, 2007), as well as studies on general Web searching behaviors (Jansen & Spink, 2006; Markey, 2007). Similar skimming behaviors were reported when the participants were examining regular webpages. Nevertheless, this study further revealed that when users were “roaming” on a page, they were actively seeking cues, which mainly manifested as medical keywords, such as symptoms, doctors, MD, and side effects, or as images. This result could be accounted by information foraging theory (Pirolli, Fu, Chi, & Farahat, 2005). It seemed that both search results and general webpages should provide salient information scent to help users with their scanning activity.

Evaluating information took place at the same time as examining information. In the examining stage, the evaluation tended to be based on keywords and focused on the potential relevance of a piece of information, and users tried to determine whether they were going to examine the source in detail. Some participants continued their evaluation when they were examining a source in more detail and, at this stage, they tried to determine whether the source was credible and trustworthy based on a closer examination of the content and related design elements. Thus, information evaluation could be viewed as a two-stage process, with Stage 1 determining whether the information is potentially relevant and useful, and Stage 2 determining whether the source is of good quality.

Five cognitive processes were identified in participants’ attempt to process information during information searching: building mental models, hypothesis testing, comparing, validating, and taking mental notes. Building mental models was at work when a participant intended to learn about various aspects about a disease or treatment. Hypothesis testing was at work when a participant came to a system with a hypothesis of what they might have and tested the hypothesis. This process helps users exclude possible diagnoses, but also may lead to conformational bias when the user was preoccupied by the hypothesis. Comparing was at work when participants compared information that they found with their own conditions or compare information from difference sources to see which was more plausible. Validating was at work when a participant formed an opinion based on the information that had been found and tried to validate the opinion from another source or another website. During the information processing, unlike middle-aged participants who conducted ongoing searches for medical information (Capra, Marchionini, Velasco-Martin, & Muller, 2010), few participants mentioned using external tools to help synthesize or memorize information. Rather, the majority reported taking mental notes to store information they thought was useful. This could be due to the fact that most of the participants’ health concerns were not chronic and they lacked the need to organize and re-access the information. However, these observations also suggest opportunities for system designers to design tools to help users in taking notes, forming mental models, comparing information, and validating opinions.

Due to the fact that most existing studies about consumer health information searching behavior employed transaction log analysis or lab testing, little is known about how users actually use the information they found. This study was able to contribute to the understanding of the final step of information searching. This study revealed that participants used the information found to reflect on their lifestyles, follow reasonable practical instructions, as well as share the information with others. This direct and immediate impact of the information on consumers’ health behaviors indicates the importance of providing consumers with more effective assistance with health information searching.

This study has limitations. Although we asked the participants to recall the most recent or memorable experience of searching for health information, their memory could be imprecise and some details could be irretrievable. Future studies could use the diary method to ask participants keep a record of their information searching process for a particular concern over a time period. Second, the participants in this study were young adults and were versed in using computer technologies. In our future studies, we will interview middle-aged or senior adults to see if the information searching process and cognitive activities differ for the two groups.

CONCLUSIONS
We interviewed twenty-one participants aged from 18-28 about their experiences related to searching for health information for one of their own health concerns. The results suggested that searching for a health concern was exploratory in nature, with users employing multiple sources and searching for multiple sessions. Additionally, the search often lasted for a period of time. In examining the results, participants employed a set of heuristics and followed salient information scents. At the same time, they quickly made judgments about the potential relevance of the information. A more close evaluation concerning the quality of the information followed when the information...
was considered potentially useful. This result indicated the importance of providing salient cues to a source.

Users performed various cognitive activities to process the information that they found during the search. Nevertheless, few made use of tools-at-hand to record or organize the information; instead, they took mental notes. The study revealed that the information found in the searching was used and shared by the participants, and impacted their lifestyle and health behaviors in both long and short terms.

ACKNOWLEDGMENTS
The author wants to thank all the participants for their valuable contributions. This study is supported by the Alumni Fellowship from the School of Information at the University of Texas at Austin.

REFERENCES


