



## How consumers search for health information

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**To date most of the research concerning consumer health information has focused on trust and quality of health information websites. In this research, we observed 48 consumers searching for four health-related topics (some of their own choosing) using Google. Using transaction logs, video screen capture, retrospective verbal protocols and self-reported questionnaires, we examined holistically the consumer's search process. Results indicate significant problems in query formulation and in making efficient selections from results lists.**

### **Keywords**

consumer health information searching

### **Introduction**

About 80 per cent of Americans have searched for at least one health-related topic [1] on the more than 70,000 websites that provide health information [2]. Approximately 23 per cent have used the web to deal with a major health issue and additionally indicated that the web played an important role in their assessment of that health matter [1]. There is a growing trend by health consumers to seek out health information independent of the medical system primarily because of the perception that the web provides convenient access to reliable health information [3] and facilitates access to content on sensitive health issues [4]. Physicians, too, have noted an increase in patient knowledge and expectations about their healthcare due to the easy access to health information on the web [5]. As a result, health consumers have moved from being passive receivers to 'active consumers' of health information [6]. This development has triggered new research directions relating to consumer health information behaviour as well as providing challenging opportunities for systems developers. Building better systems requires a holistic understanding of how health information consumers interact with the web and with the content they find on the web.

## Previous research

To date, consumer health information research has dealt with myriad issues including communication with doctors [7, 8], the negative perceptions of doctors when faced with a knowledgeable patient [9], the quality and accuracy of the information available on the web [10, 11], and the difficulties consumers have in evaluating the quality of that information [3]. Concerns have also been raised about commercial interest in health information and its potential impact on the consumer [12]. A significant issue is the volume of information on the web and how that creates a barrier to finding the best information which has spurred an interest in the development of specialized search engines [13, 14]. Sillence and colleagues [15] examined the transcripts from 'talk alouds' and logs maintained while 15 women searched for a specific health topic. Notably layout and presentation were considered important in assessing credibility of the information. The more professional the site appeared, the more reliable it was perceived to be [15, 16]. These research studies have focused primarily on the content, rather than on how that information was found in the first place.

Some studies of consumer web searching for health information (sometimes called consumer health information retrieval) have been conducted using surveys particularly in the medical and sociology fields. In one of these studies, Schwartz and colleagues [17] surveyed 1392 family medicine patients about the types of health information they search, how they search, and how they assess the accuracy of the information they find. Notably, 79 per cent searched for specific diseases or conditions while 53 per cent searched for medications. Most reported that the information found was understandable and trustworthy. Respondents tended to look for government endorsements or reliable sources when assessing the accuracy of a website. When asked about strategies, 82.5 per cent entered keywords into a search engine, which is less than the 95 per cent reported by Eysenbach and Kohler [16]. While surveys enable one to collect a variety of self-reported personal perspectives and opinions, they do not illuminate the process. Entering keywords is not a search strategy but a mechanistic approach that does not reveal the underlying strategy that a consumer might be pursuing, and does not enable the development of system specifications.

Few studies emanating from the medical literature observe the search process. A search typically contains a series of steps that are usually iteratively repeated: query formulation, selection from a results list containing a set of surrogates, and thirdly, the examination and assessment of a document that matches the query. Of the few studies that examine this process, Eysenbach and Kohler [16] found that 65 per cent of the search queries entered contained a single keyword and only 3.5 per cent contained a phrase. In addition, participants rarely went beyond the first page of search results. Zeng et al. [18] similarly found that 63 and 72 per cent of searches contained one to two words, noting that the limited search query was due to the difficulty in understanding and use of medical terminology.

Zeng et al. [18] created a Health Information Query Assistant to recommend alternative or additional query words in an effort to assist the consumer in query formulation. In a comparison of the system as a Google add-on with the native Google, 213 participants achieved a 76 per cent success rate. Success in this case was a relevant result in the top 10 on the results list.

Given the scarcity of research that examines precisely how people search for consumer health information, a holistic study using a mixed methodologies approach was designed to assess the multiple facets of the search process. The data used in this analysis are part of

a larger study that compared searching in four domains: general research, online shopping, travel and consumer health [19]. In the work reported here, we examine in detail the results for the consumer health area only. The goal of this work was to understand:

- 1 how people specify their information requests
- 2 how they select from search result lists
- 3 how they examine the page(s) they declare relevant to the information search problem.

## Methods

To respond to our objectives, we recruited 48 people to perform a set of searches using Google. We collected several types of data using several techniques (questionnaires, transaction logs, screen capture, and audio recording) to capture a range of variables.

### *System used: Google*

The Open Directory categories were added to the Google search engine page. This page contained the instructions: 'Please enter your search or select from the directory categories below.' Beyond this page, the standard Google interface screens were retained. The directory was added to provide an alternative option – a scan capability – for the user. Google was selected based on its status as the top consumer search engine.

### *Task*

Four tasks, which had been devised by the TREC 10 Interactive Track (<http://trec.nist.gov>), were used in the study. Of the tasks, two were fully specified:

- 1 Tell me three categories of people who should or should not get a flu shot and why.
- 2 Find a website likely to contain reliable information on the effect of secondhand smoke.

and two could be personalized:

- 3 List two of the generally recommended treatments for \_\_\_\_\_ (fill in the blank with a health-related matter that interests you).
- 4 Identify two pros or cons of taking large doses of \_\_\_\_\_ (fill in the blank with a drug or treatment or remedy that interests you).

### *Participants*

Adult members of the general public who had used the web, but who had not taken a professional online search course, were recruited for the study. The sample was one of convenience; participants self-selected. They were recruited in two Canadian cities (Toronto and Vancouver) from printed posters on campus bulletin boards, libraries and coffee shops, and via e-mail messages posted to listservers or e-notice boards at the research sites. Thirty-two were from Toronto and 16 were from Vancouver.

The 29 women and 19 men ranged in age from 18 to over 65, with 71 per cent between 21 and 35 years old. Most had university-level education, mainly at the bachelor (18) or masters (14) level, predominantly in the humanities or social sciences. About half were students; the remainder were from a diverse range of occupations. Almost all participants (94%) had been using the web for 2 or more years, and most were moderate web users. Overall, they were a relatively young, educated group who were experienced in terms of web use.

### *Procedure*

Each participant responded to one of the four tasks. Participants first completed a demographic and web/search experience questionnaire, and then executed the following steps:

- 1 A pre-search questionnaire about their familiarity and expertise with the search topic to be completed.
- 2 The assigned consumer health task using Google. Participants were not disturbed for this part of the test, although the researcher remained in the room. During this time, screen capture video software recorded the search activity and a transaction log stored time-stamped user actions. Participants were requested to print the pages they believed useful to the task; these print commands were recorded in the transaction log along with other actions such as the query, categories selected and pages examined.
- 3 A post-search questionnaire about their perception on completing the task.

After these three steps, the screen capture video was replayed while participants commented on their decision making process in completing the task. This included reviewing the query creation (and/or category selection), how they approached the results list, and how they determined whether a webpage met the needs of the task.

### *Data analysis*

The transaction log data were coded according to the stages in the search process, and merged with questionnaire data for analysis using SPSS. The interviews were loaded into a qualitative software package, Qualrus, and coded according to stage in the search process. In addition, external judges assessed the 'aboutness' of each page declared relevant to the task, as well as the completeness of the task using the pages that were printed (i.e. indicated as pertinent).

## **Results**

### *Summary*

Most participants (nearly 90%) had not searched the web for these search topics before, but indicated being 'somewhat familiar' to 'very familiar' (66%) with the topic of the search. On average, participants created 1.3 queries for each search task. Each query contained on average 4.2 keywords, of which 3.2 were stopwords (and thus not processed by the

search engine). About 63 per cent used the searchbox to enter a query, 6 per cent chose the categories, and the remainder used mixed approaches, either starting with a query and then using the categories (10%) or vice versa (21%).

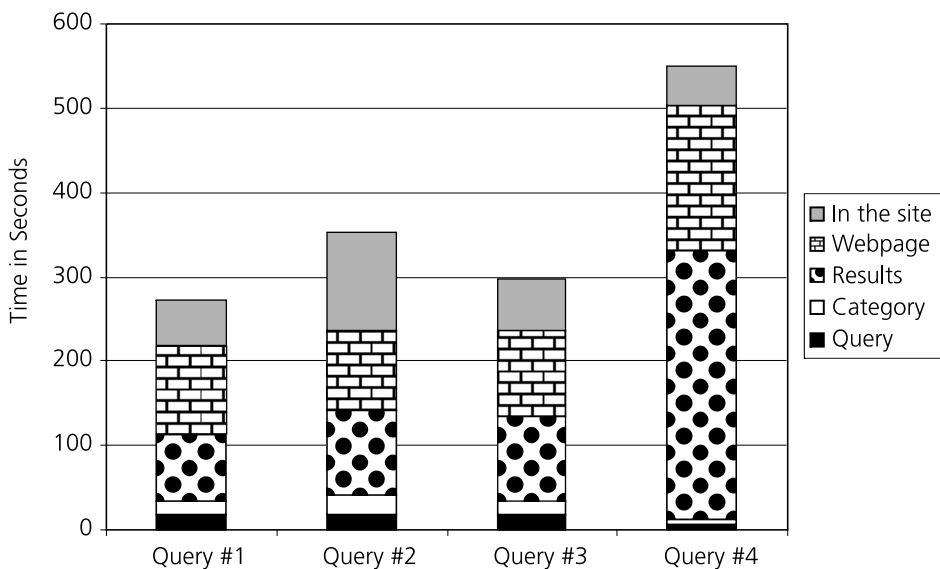
In addition, the amount of time spent on each task was examined. As seen in Figure 1, participants spent an average of 4.5–9 minutes per task. But notable from the chart is the amount of time spent on the results page, compared with the amount of time spent creating a query, examining the webpage selected from the results list, or further examining pages deeper in the site ( $F(4, 47) = 8.08, p < 0.001$ ). *Post hoc* comparisons indicate that participants spent as much time interpreting the results list as in comprehending the information presented on the webpage.

### *Formulating queries and selecting categories*

For each of the tasks, participants varied in the queries they created to search for information on each topic. Tables 1 and 2 illustrate that variability in query entries and category selections for the first and second search topics. The ‘flu shot’ query in particular illustrates the range of possible queries used to locate appropriate information; 23 entries were provided by the 12 people who responded to this search task. The second one (see Table 2) had less variability in query content.

Because the other two tasks were personalized, the exact search queries and/or categories used are not provided. Below is the variety of information problems that were searched and thus used in our data collection:

- *List two of the generally recommended treatments for \_\_\_\_\_.* Participants searched for: cancer, epilepsy, thyroid cancer, heart blockage, flu, hearing loss, depression, sunburn, poison ivy, dyslexia, halitosis treatments, lower back pain.



**Figure 1** Time spent at each

**Table 1** Queries and categories for the topic: 'Tell me three categories of people who should or should not get a flu shot and why'

<i>Queries</i>	<i>Categories</i>
Age for having a flu shot	Health
CMA recommendations flu shots	Conditions and Diseases
Flu	
Flu shot	Health
Flu shot contraindications	Pharmacy
Flu shot problems	Drugs and Medications
Flu shots	B
Flu shots Canada recommendations	
Health	Health
Health Canada	Pharmacy
<a href="http://www.gov.on.ca">http://www.gov.on.ca</a>	Drugs and Medications
National Institute for Health	F
Risk recommendations flu shot Canadian	Health
The New England Journal of Medicine	Pharmacy
Who is eligible for flu shots	Drugs and Medications
Who should get a flu shot	E
Who should not get flu shot	
Who should or should not get a flu shot and why	Medicine
Who should or should not get a flu shot and why	Pharmacology
<a href="http://www.gerstein.library.ca">www.gerstein.library.ca</a>	
<a href="http://www.library.utoronto.ca">www.library.utoronto.ca</a>	
<a href="http://www.yahoo.com">www.yahoo.com</a>	

- *Identify two pros or cons of taking large doses of \_\_\_\_\_.* Participants searched for: pain killers, cortisone, tylenol, vitamin C+, sleeping pills, beta-carotene, steroids, risperdol, echinacia, ibuprofen, aspirin.

In addition to examining transaction logs, the post-search interviews further illuminated the issues with regard to query construction and category selection. When searching for information, participants displayed distinct preferences in terms of the processes used to formulate queries. The most commonly used and most preferred method was the use of a keyword search on either a search engine or a website of interest. While popular, the keyword search constituted a sort of 'trial and error' method. One participant likened the choosing of search words to the 'luck of the draw', while another identified finding the correct balance between general and specific approaches as an inherent challenge to formulating a successful query for keyword searches: 'I've learned from past errors of judgment to put as much as I can ... [to be] specific but not wordy. To the point.'

Despite these challenges, participants believed they had a higher level of control over the search process and results when utilizing this method. A key component of this control stemmed from participants' ability to choose their own search words. This allowed

**Table 2** Queries and categories for the topic: 'Find a website likely to contain reliable information on the effect of second-hand smoke'

<i>Queries</i>	<i>Categories</i>
CNN health	Health
Effect of secondhand smoke	
Health	Health
How is the effect of secondhand smoke	Substance Abuse
Secondhand smoke	Tobacco
Secondhand smoke effects	Teen Smoking
Secondhand smoke and Canadian government	Health
Secondhand smoking effect	Substance Abuse
Smoking effects	Tobacco
The effect of secondhand smoke	Secondhand Smoke
The effect of secondhand smoke	Health Risks
Tobacco secondhand	
What are the effects of breathing secondhand smoke	Health
What are the effects of secondhand smoke	Public Health and Safety
What are the health effects of secondhand smoke	Medicine
	Medical Specialties
	Nuclear Medicine
	Science
	S
	Science
	Health Physics

them to define the search, but also to refine it in a manner of their own choosing. For example, one participant felt that adding specific words to their search made it more 'robust.' Rather than formulate a query for 'effects of secondhand smoke,' a more specific query was created for 'the effects of breathing secondhand cigarette smoke'. Other participants restricted their search by source of information. One participant used the word 'Canadian' in the search in an attempt to restrict the results to Canadian recommendations, while another participant, concerned about the reliability of the source of information, chose to limit the search by using the words 'Canadian government'. Other approaches to conducting keyword searches were also identified including the preceding of search terms with a plus sign to ensure results fell within a common page and encapsulating search terms in quotation marks to ensure that all terms were found together in sites identified in the search results.

The use of the keyword search was preferred over the use of categories. Categories were more often viewed as an impediment to finding information than a useful form of assistance. Participants spoke of a lack of 'patience to go from screen to screen'. Participants also noted that the use of categories was a less direct route to locate information; categories resulted in 'more steps' and were a source of too general a type of information that would

force them 'to go through with the large generalizations that I want to avoid'. In addition, categories were perceived as a potential route to exposure to more advertisements. The main deterrent for the use of categories, raised by several participants, was the perceived time it would take to find the information being sought: 'I don't know how much time I'd waste trying to find the right category.'

However, one participant indicated that if they knew enough about the topic they were searching for, and in which category it might be found, she might utilize the categories:

I knew that this one would come up under health and ... that would be there.

Whereas other stuff ... I'm not really sure where it's going to go ...

*Interviewer:* So if there's a clear first step, you then you're more likely to go?

*Subject:* Yeah.

### *Selecting from the results list*

Only 16 per cent examined just the first page of results. While on average 5.4 pages (median = 4) of results lists were examined, the range extended to 22. The average rank on a results list page was 4, with a range from rank 1 to rank 9. Thus all items on the results page had an equal likelihood of being selected.

The post-search interviews further illuminated the issues regarding how the results lists were examined and how items were selected from those lists. Unlike the formulation query process, participants reported a more methodical approach to determining which options to choose from the results list. Although participants tended to scan results lists, they most commonly attended to the summaries and URLs provided as a means of selecting the most appropriate links to explore. Descriptions assisted participants in determining how closely the site matched their perceived information needs and thus served an important part in the selection – or deselection – process. The URL was used to identify the nature of the site (e.g. an information-based site versus an e-commerce site), and to assess the kind of information on the site. Headers or titles were the next most commonly used sources of information for selection. Other kinds of information contained in the results list entries such as dates, size of the site, and type of file (e.g. PDF) were the least utilized sources of information. A few participants noted that they looked at the number of results on the results list. In one case, the participant indicated that a large number of results would serve as an indication that their search needed to be refined, while another participant indicated that a large number of results would affect their ability to scan the list. Rather than attempting to scan all of the returned results, the participant was more likely to jump to pages further down if the initial results did not appear to be relevant.

As noted, the URL was a key source of information for assessing items on the results list. In fact, it was used by participants to assess the potential credibility of the information that would be found:

I was doing some critical thinking about what kind of information I would get and where it would come from. In addition to reading the descriptions I was also very careful about reading the URLs to see where the information was coming from.

Participants considered university, government, scientific, pharmaceutical research information, and associations for medical professionals to be reliable sources. As evidenced



by the comments of one participant, however, credibility is a subjective assessment based on personal opinion, and possibly prior knowledge and/or experience:

And I don't know why I didn't choose that one. I thought about choosing that one, but I thought, 'Well, what is the [X]?' I mean it's corrupt anyway. That's what I thought.

Overall, participants did not appear to consider the rank order in which results appeared on the results list as a criterion for determining appropriateness or credibility. Participants reported commonly looking at links several pages into the results list. In fact, choosing the first link on the results list may be a matter of convenience as it is the 'quickest' one to access, may represent the participant's usual way of proceeding through the results list, or may be a matter of simply finding a starting point in a process of trial and error:

I sort of started scanning it but again you don't really know what exactly they're going to have so I just figured I'd try the first one because why not?

### *Identifying appropriate websites*

Participants selected on average 2.6 web pages from the results page, and examined a further three web pages once they got to a useful site. Each webpage was examined for its pertinence to the task. Our judges concurred with most participants: the average web page 'aboutness' was 4.5 (out of a maximum of 5). In addition, all pages identified as relevant to the task were assessed by an external judge to determine if the set could adequately respond to the task. The judges assigned, on average, a score of 4.5 (out of a possible maximum of 5) for the tasks. Thus the pages examined by participants were clearly on the topic of the search, and participants were able to complete between 80 and 100 per cent of each task. Of the pages declared relevant, 44 per cent had no advertisements, and 40 per cent were created by a government agency. The pages were classified primarily as informational, and including a range of genre from journal articles to fact sheets and newspaper articles.

The post-search interviews provided additional evidence about the identification of an appropriate web page. After choosing a link from the results list, participants then needed to determine the degree to which that link satisfied their information needs. As confirmed by the quantitative data described earlier, judgements were formed quickly after an initial scan of the site. Initial impressions, and subsequent use or rejection of the site, involved at least one of the following three key considerations:

- 1 *Information expectations*: does the site provide any or all of the information being sought?
- 2 *Information quality*: who is the author of the site and the information contained therein? What is the purpose of the site (e.g. to provide information, to sell products, to promote unsubstantiated opinions)? How is the information presented (e.g. opinion-based articles, discussion group, academic research, formal medical findings)?
- 3 *Information presentation and accessibility*: how difficult is it to find the desired information on the site? Is the information easy to understand?

As expected, sites providing the information being sought were considered for use while those not meeting information needs were quickly rejected. As with the selection of links

from the results list, the perceived credibility of the information on the site was of prime importance. Credibility was established by looking at factors identified as part of information quality. Participants tended to look for recognizable authoritative sources (e.g. Centre for Disease Control (CDC)), or sources with the appearance of authority (e.g. physicians):

I didn't really take full weight for this because I didn't know who the web host was ... it could have been any Joe Shmoe ... I didn't take it as seriously as a university or something like that.

Participants also considered the apparent motivation of the site and the way in which information was presented in determining credibility. Disappointment was expressed with sites aiming to sell products or presenting information in a manner perceived as less formal or authoritative.

Ease of finding and understanding information also impacted the use of a site. Concise layouts with clear menus and elements such as search boxes and bullets or titles to partition text facilitated information finding and encouraged the use of sites. Sites that were poorly laid out, perceived as too technical, or utilized pop-up or sidebar advertisements with unrelated information were sources of irritation and, thus, provided cause for participants to opt for other sites. As one participant said, 'it was the combination of it looking commercial, and the information not being there, and the links being all in a blob as opposed to nicely laid out. I just left.'

## **Analysis and discussion**

In this study users were more likely to perform keyword searches, but those queries did not always lead to immediate success. Based on the range of queries that were entered for many of the search topics and the time taken to do so, it is clear that query formulation was quickly executed and was very much one of trial and error. The topic of query length has been reported in many prior studies of web searching [20] and the results of our study are no different. But notably when participants are encouraged to increase the length of their queries, the problem is twofold: participants appear reluctant to add to a few simple keywords, and search engines often remove those words that make a query meaningful to a user [21]. Thus attempts by people to improve their query construction are being limited by the system, and apparent system improvements are not realized by users.

Keyword searches were diverse depending on what participants perceived they were looking for, their knowledge of the area, their biases in terms of credibility, and their personal understanding of the topic. Of note, the use of categories to find information shared some of the same issues faced by keyword searches. Their use did not appear to be any more intuitive than keyword searching, and was also one of 'trial and error'. Some knowledge of the topic appeared helpful in category selection which has been the case for other domains. Not understanding what a category contains is often a barrier to use, and additionally, the presentation of a seemingly endless set of category levels is not conducive to effective use.

The results lists were pivotal to task success. Results lists were rigorously scrutinized before the participant was willing to take the risk of clicking on a possible link. This is unlike those who search for product purchase [19]; consumer shoppers, for example, tend

to make quick decisions at this point. Indeed, our participants scoured pages of results before selecting even the first link, looking for hints that the target page was likely to be suitable and pertinent. Past studies have shown that consumers are more likely to access the first few sites listed on a search engine [16], but that was not the case in this study. Participants examined multiple results pages, scrutinizing each summary on those pages for its pertinence. This often was for information that is accidentally found in a result summary, rather than pieces of information included in accordance with the design of results pages. Considering the proportion of time participants took to select from the results pages, it is clear that the information design of this page constitutes a significant barrier to the online health consumer.

When assessing web pages, participants appeared to examine or abandon a page quickly, but during that time were often considering several key components simultaneously. Participants made potentially erroneous decisions based on their perceptions of web page appearances. The perception of authority based on layout and presentation was equally present in this study as it has been in past studies [15].

Credibility and trust were key issues for both selection from results lists, and selection of an appropriate web page. Participants appeared to resent commercial sites or advertisements, especially when they wanted to find useful and pertinent information. In our data, nearly half of the pages declared pertinent had advertisements on them. Past studies have expressed concerns about how people interpret sites that sell [22]. In this study, our participants were quite concerned about the reliability and credibility of those sites, and worked hard to avoid them.

Clearly, participants were able to locate possible answers to the questions, but those answers took some effort. In particular, the challenges identified were in formulating good queries, and having appropriately designed and standard results lists to enable easy scanning and efficient recognition.

While the prospect of specialized medical search engines has been proposed and discussed elsewhere [13], the solution may lie more with systems like the Health Information Query Assistant [18] that provides assistance to query development, and to non-for-profit portals that evaluate the information that is being provided. A key to successful queries is in the underlying terminological infrastructure that supports the search process. Such an infrastructure would need to be flexible and responsive to the efforts of both laypersons and experts.

A further challenge comes with the development of appropriate summaries. Results lists were conceived from large bibliographic databases developed in the 1960s for scientific research literature and library catalogues, as a means of providing an ability to scan a list of items quickly. While search engines have adopted that mode, the summaries have been extremely limited, and the KWIC style format preferred. In the realm of consumer health information, the format and content of that structure needs to be rethought with the consumer in mind. These summaries on the results list need to indicate the reliability and credibility of the documents they represent, alerting the user to the type of site and information content (e.g. e-commerce, academic, government).

## Conclusions

In building good consumer health information systems, information design and search engine technology need to meld. Also integral is a user-focused perspective that reflects an

understanding of users' need for information and how people search for that information. Likely, building a taxonomy or framework that incorporates the relevant components from these two perspectives can aid in creating appropriate information structures that support findability and use.

Searching for consumer health information remains a challenge for the average person. The web is a 'free-for-all' domain. Like other types of information, health information is voluminous, can be created and hosted by a variety of persons with a variety of motivations, and is being accessed by people with vast differences in comprehension, searching abilities, and levels of information needs. The challenge for researchers and developers is how to structure something so unwieldy, while at the same time making it intuitive.

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