

# An Observational Study of How Young People Search for Online Sexual Health Information

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**Abstract.** Little is known about the quality of online sexual health information, how young people access the Internet to answer their sexual health questions, or an individual's ability to sort through myriad sources for accurate information. **Objective:** The purpose of this study was to determine how college students search for online sexual health information and whether they retrieve accurate answers to sexual health questions. **Participants:** In fall 2007, the authors recruited 34 first-year, first-semester undergraduates to participate in an observational research study, using Camtasia Studio. **Results:** Most students found accurate answers to the 12 sexual health questions posed. Finding local information and resources online proved more difficult than finding answers to general sexual health questions. **Conclusions:** The Internet has become the leading source for sexual health information. Based on their findings, the authors argue that young people must be educated about how Web search engine results are prioritized/displayed and trained to evaluate Web sites for reliable information.

**Keywords:** college students, health information, information seeking, Internet, sexual health

Compared with the US general population, students enrolled in 2- and 4-year colleges are the most frequent Internet users.<sup>1</sup> The estimated 18 million students who arrived on a US college campus for the 2007–2008 academic year are a part of the most “wired” class to date; it has been estimated that approximately 95% of these students will use the Internet at least once a month.<sup>2</sup> Historically, there has been concern that spending time online may lead to increasing levels of social isolation<sup>3</sup> and interference with other aspects in students' lives.<sup>4</sup> However, the Internet is now being used to manage all aspects of academic and social life,<sup>5</sup> including to conduct research, communicate with professors, classmates, and friends, form new relation-

ships, share photos, watch television shows, and seek health information. Of 15- to 24-year-olds who have ever gone online, for instance, 75% have used the Internet to look up health information—more than the percent of young people who report playing online games (72%), downloading music (72%), participating in chats (67%), shopping online (50%), or checking sports scores (46%).<sup>6</sup>

The Internet is the preferred outlet for learning about embarrassing health topics—topics that young people feel uncomfortable discussing with parents, educators, health care providers, and other adults.<sup>7</sup> These health topics include issues such as sexuality, body changes, menstruation, physical/sexual abuse, contraception, pregnancy, and sexually transmitted infections (STIs).<sup>8</sup> Accordingly, sexual health is one of the most common health topics for which young people search the Internet.<sup>9–12</sup> However, little is known about the quality of online sexual health information,<sup>13–19</sup> how young people utilize the Internet to answer their sexual health questions,<sup>13,14,18,20,21</sup> and an individual's ability to sort through myriad sources for accurate information.

Several research studies have examined individuals' experiences searching for general health information online by assessing diary records<sup>9</sup> and self-report surveys.<sup>10–12,22,23</sup> Although useful, these studies simply report the content on which individuals search and did not address *how* individuals find online information. To date, only 4 studies have been identified that utilized *observational computer applications* to track Web health information search behavior. First, Eysenbach and Kohler<sup>24</sup> studied how German adults searched for and appraised online health information, using Surf Spy. Adults were asked to find answers to 8 or 9 health-related questions, which were not disclosed in the article. Participants were older and more experienced, in terms of health knowledge, than college students; 3 of the 17 adult study participants were nurses.

Second, Hansen et al.<sup>15</sup> studied how a small group of American adolescents searched for online health

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information, using Camtasia Studio, a software package that gives users the power to record their computer screen and audio simultaneously. Adolescents in this study were asked to find answers to 6 health-related questions, with 2 questions relating to sexual health—find a local place to get a free and confidential human immunodeficiency virus (HIV) test and find whether tattoo parlors spread infections such as HIV and hepatitis. This study involved a small sample ( $N = 12$ ), and was intentionally constructed to avoid controversial topics such as safer sex, abortion, and homosexuality.

Third, Birru et al.,<sup>25</sup> also using Camtasia Studio, investigated how adults with low-literacy accessed and evaluated online health information. Similar to the Hansen et al.<sup>15</sup> research, this study involved a small sample ( $N = 8$ ) and asked only 3 health-related questions, concerning lung cancer, diabetes, and a topic of interest to each participant.

Only a single study has been found to date that examined locating online *sexual health* information, specifically. Smith et al.<sup>18</sup> studied how 27 college students found 2 items over the Internet: “a textual or graphic description of the proper way to put on a condom,” and “a Web page that describes the symptoms of STDs” (p. 687). The authors recorded the search engines and keywords most frequently used by college students to find answers. Although this study was groundbreaking, several limitations are apparent. First, the authors were not clear as to whether *accurate information* was found by participants. Second, the procedures students employed to find answers (e.g., clicking on the first result listed in a Google search) were not disclosed. Third, only 2 sexual health questions were asked (thus, students’ ability to find information other than STI/safer sex information remains unknown). Fourth, students were instructed to use a search engine (thus, students may not have conducted their information search in a regular manner [i.e., they were not allowed to go directly to a trusted health information site if they wanted to]). Lastly, data on search start/stop times and the number of clicks students used were recorded by the student, and not the researcher (thus, some of the data collected may have questionable validity).

The current research attempts to compensate for limitations identified in the literature above. For instance, important questions remain about whether young people find accurate information on the Internet related to the multitude of sexual health topics. This study assesses students’ search strategies and their ability to find accurate information on a broad range of sexual health topics: reproductive health, contraception/family planning, pregnancy and prenatal care, abortion, STIs, and sexual abuse, assault, and violence, all areas outlined in the *Guidelines for Comprehensive Sexuality Education*<sup>26</sup> (i.e., not simply information about HIV and condoms, on which previous studies have focused). Hence, the purposes of the current study were to determine, through observational means, how first-semester, first-year undergraduate students search for sexual health information on the Internet and whether they retrieve accurate answers to sexual health questions online. This study sought to answer the following research questions:

1. When asked questions about sexual health, do college students find accurate answers online?
2. How do students find sexual health information on the Internet?
  - a. What search strategies do students employ?
  - b. Do students visit trusted health Web sites or do they utilize Web search engines?
  - c. How much time and “work” is involved in an online search for sexual health information?
3. How do students evaluate Web sites?
  - a. What thought processes are employed to identify pertinent sexual health information?

## METHODS

Following approval from the authors’ Institutional Review Board, we conducted the current research utilizing a cross-sectional, observational study design, carried out in 3 phases. In phase 1, a panel of university health service staff (nurses, nurse practitioners, physicians, and health educators), community health care providers, and sexuality educators was convened to identify common sexual health–related questions being asked by college students and young adult clients. Because of their regular and direct involvement both with this population and with related sexual health issues, the panel assisted in the construction of 12 realistic sexual health scenarios which were then posed to study participants in phases 2 and 3. Also in phase 1, we adapted items<sup>23,27</sup> and developed new items for a brief questionnaire asking about students’ Internet experience, past health and sexual health information–seeking behaviors, and demographic characteristics.

In phase 2, a convenience sample of 6 first-semester, first-year undergraduate students was recruited to pilot test the sexual health scenarios developed in phase 1. The pilot test also allowed for an assessment of the data collection protocol and the observational technology (i.e., Camtasia Studio software) to be employed in phase 3. Results from the pilot test were used to refine questionnaire items and to improve data collection procedures.

Phase 3 involved the purposive sampling of 34 first-semester, first-year undergraduate students in an observational study of Internet sexual health information-seeking behavior. Observations of students were made in the fall of 2007 in an office setting using Camtasia Studio.<sup>28</sup> Students were recruited (at the authors’ institution) through all sections of *Introduction to Anthropology*, a general education course that attracts a diversity of majors, genders, and racial/ethnic students. Students were invited, individually, to participate in a confidential 90-minute observational research study. In a typical office setting, each student was placed at a private computer workstation with Internet access. After completing the brief questionnaire, students were provided with 12 sexual health scenarios (Figure 1), one at a time. Students were asked to locate appropriate information on the Internet to help answer the question in each scenario.

1. Mary has been hearing a lot about the HPV vaccine, a vaccine that protects against several types of the human papillomavirus, a common sexually transmitted infection (STI). Mary is considering getting the vaccine. Using the Internet, find out who can get the HPV vaccine.
2. Henry recently shared with his friend that he only engages in oral sex because he does not want to have to worry about STIs. Using the Internet, find out if Henry can get an STI through oral sex. If he can, name one STI he could get through oral sex.
3. Sarah has not used protection every time she has had sex. She is concerned about her health and would like to get tested for HIV/AIDS. Using the Internet, find one location in the local metropolitan area where Sarah can get an anonymous HIV test.
4. Tom has a latex allergy and is unable to use latex condoms during sex. Using the Internet, find out what other type of condom Tom can use instead of latex to protect himself against STIs.
5. Amy confides to her friend that she is 4 weeks (28 days) pregnant and considering having an abortion. Use the Internet to find one type of abortion Amy can have.
6. Maria and José had sex last night with a condom, but the condom broke. They are worried that Maria may become pregnant and are considering using emergency contraception (EC, morning after pill, or Plan B). Use the Internet to find out how many hours after sex, at a maximum, EC can be used effectively to prevent pregnancy.
7. Crystal has been taking an oral contraceptive consistently for more than one year. For the first 3 weeks of her birth control pack, Crystal takes an active, hormonal pill. For the last week of her birth control pack, Crystal takes a placebo pill which does not contain hormones. Since she has been on the pill, Crystal has heard from several friends that she could become pregnant during the placebo week of her birth control pills. Go on the Internet to find out if Crystal is still protected against pregnancy during the placebo week of her birth control pills.
8. Shawn is wondering whether the size of his penis is normal. Go on the Internet and find out the average length of an adult's erect penis.
9. Jennifer has been having a difficult time adjusting to college life. To help her through her adjustment phase, Jennifer has been attending counseling sessions and taking an antidepressant. Since she started taking the antidepressants, Jennifer has noticed that she has little interest in sex with her boyfriend. Go to the Internet to find out if antidepressants can decrease a person's sex drive.
10. Amanda, a freshman at the University, is in the library studying until midnight most nights. Amanda is always anxious when she walks back to her dorm after these late night study sessions. Amanda recently heard that the University offers a campus safety escort service. Using the Internet, find the phone number for this student service.
11. Ryan has been drinking a lot lately and having unprotected sex. Using the Internet, find one way alcohol can impact Ryan's sexual decision-making?
12. Julia was at a party this weekend and, after having only one beer, she passed out. Julia does not remember much about that night and believes she was drugged and raped. Using the Internet, find one place in the local metropolitan area where Julia can go for after-rape care and support.

**FIGURE 1. Sexual health scenarios.**

Once students finished, they were debriefed with the correct answers to all 12 scenarios and remunerated with \$30 for their time.

In addition to having the ability to record a computer user's screen, a powerful feature of Camtasia Studio is its ability to record a user's audio simultaneously.<sup>28</sup> In this study, students used a microphone headset to "talk out loud" what they were doing, so that the reasons behind their search behaviors could be analyzed and understood. According to Hansen et al.,<sup>15</sup> "concurrent verbal reports more accurately reflect a [participant's] mental state at the time of observed behaviors than do retrospective reflections, and this minimal think-aloud protocol has been shown to slow [participants] down, but not to qualitatively change their problem solving behavior."

Both quantitative and qualitative data were collected and analyzed. In addition to whether students found the correct answers, the amount of time taken for students to locate answers to each question was recorded, as was the number of mouse "clicks" each student made—a measure of *work* required, in an Internet search, to navigate from site to site to locate answers. Whether students overlooked answers during their Web search, the number and names of search engines used, and Web sites visited were also tallied. The questionnaire developed for the study consisted of questions regarding where participants sought their health information, generally, and their sexual health information, specifically. The instrument consisted of 14 questions, which were derived from the literature on health information seeking, and from the

preliminary discussions with the study's panel of sexual health experts. These data were entered into SPSS 16.0 to generate descriptive statistics.

In terms of qualitative information, students' verbal reports explaining their Web search behaviors were recorded by 2 data extractors from the Camtasia Studio recordings. All of the qualitative data were then compiled and independently analyzed by the authors to identify emergent themes. Next, all authors came together to finalize and clarify the emergent themes. After themes were finalized, the qualitative data were reanalyzed and assigned to their appropriate theme.

## RESULTS

### Sample

The sample ( $N = 34$ ) was purposively recruited to reflect the sex and ethnic/racial composition of all first-year undergraduates enrolled at the authors' institution. All students were 18 or 19 years of age at the time of data collection (fall 2007). Two thirds were female ( $n = 23$ ) and 70.6% of participants self-identified as White, whereas 8.8% identified as African American, 5.9% identified as Asian, 2.9% identified as Pacific Islander, and 8.8% reported some other race. Six students (17.6%) self-identified as Hispanic or Latino. Most students were experienced Internet users; 88.2% reported using the Internet "several times a day" and the average student reported being an Internet user for almost 8 years ( $M = 7.93$ ,  $SD = 1.95$ ).

### Questionnaire Results

#### Health and Sexual Health Information Seeking

Seventeen topics were included in the items related to how participants have ever asked for and sought health information. Among those topics, the Internet was the source visited most frequently for 11 (65%) of them (Table 1). Sexual health was the most common topic on which students reported *ever seeking online* (76.5%), followed by information about a specific disease or medical problem (73.5%), a certain medical treatment or procedure (73.5%), and diet, nutrition, vitamins, or nutritional supplements (70.6%). Fewer students sought sexual health information from a physician (35.3%), relative (32.4%), or friend (32.4%).

Information about STIs/HIV was the most common sexual health topic on which students reported *ever seeking online*; 70.6% reported seeking out this information online at some point in their lives (Table 2). More than half of students also reported ever seeking information online related to male or female genitalia (such as the size of a normal penis; 58.8%), preventing pregnancy (52.9%), and contraceptives (50%). For 11 out of the 12 sexual health topics listed, students reported the Internet as the most commonly utilized source of information; fewer students sought out information from physicians/health care providers, friends, and relatives.

#### Past Online Search Experiences

Almost two thirds of students (63%) reported, at any point in their last search for health information, feeling *reassured* they could make appropriate health care decisions. Almost half (48.1%) reported feeling *relieved or comforted* by the information found online, whereas 44.4% reported feeling *confused* by the information. Based on their last search for online health information, students also acknowledged feeling *eager to share this information* (33.3%) and *confident to raise new questions* or concerns about a health issue with a physician (29.6%). Still, one quarter (25.9%) of the students reported feeling *frustrated* by a lack of information or an inability to find something online, and some students were *overwhelmed* by the amount (18.5%) or *frightened* by the serious or graphic nature of the information found online (14.8%).

Slightly more than half of students (51.9%) reported that they either *never* or *hardly ever* look to see when the information on a health Web site was last updated or reviewed by a medical professional. Very few students reported that they either *always* (3.7%) or *most of the time* (7.4%) look to see when the information on a health Web site was last updated or reviewed.

#### Observational Study Results

After being presented with the 12 scenarios, students most often commenced their sexual health information searches by visiting a search engine. Google was the most frequently utilized search tool, used by all but 2 students (94.1%). Yahoo and Ask.com were the next most frequently used search engines, with 3 students visiting each search site. Slightly more than one quarter (26.5%,  $n = 9$ ) of students followed a search engine "sponsored link." In terms of navigating search engine output, most students accessed one of the first several search results. In scenario 1 for example, among those students who did not follow a sponsored link, 79.3% clicked on 1 of the first 3 search results. Similar results were found for the other scenarios.

The 34 students varied in terms of locating the correct answers to each of the 12 scenarios. For instance, all students correctly answered the scenario pertaining to the emergency contraception time frame for effective use (scenario 6; see Table 3). Only half of students, however, were able to find out where someone can get an anonymous HIV test in the local metropolitan area.

Students also varied on the amount of time and work needed to locate an answer, depending on the scenario. For instance, the most time-consuming scenario (no. 12) was finding out "where someone can get after-rape care and support in the local metropolitan area"; students, on average, took 317.8 seconds ( $SD = 341.0$ ) and made 15.3 mouse clicks ( $SD = 18.6$ ) to locate an answer to this scenario (Table 3). The next most time-consuming scenario (no. 7) was finding out "whether a woman can get pregnant during the placebo week of her birth control pill pack." The least time-consuming scenario, no. 6, was "how long after

**TABLE 1. Percentage of Students Reporting Ever Asking About or Looking for Health Information From 4 Sources (N = 34)**

Health topic	% of students seeking information from physician/health care provider	% of students seeking information from a friend	% of students seeking information from a relative (including parent)	% of students seeking information online	% of students never looking for this information from any of these sources
A specific disease or medical problem?	64.7	50.0	67.6	73.5*	2.9
A certain medical treatment or procedure?	47.1	20.6	55.9	73.5*	2.9
Experimental treatments or medicines?	8.8	2.9	5.9	47.1*	52.9
Alternative treatments or medicines?	17.6	11.8	14.7	47.1*	47.1
Diet, nutrition, vitamins, or nutritional supplements?	32.4	38.2	55.9	70.6*	5.9
Exercise or fitness?	32.4	70.6*	55.9	67.6	5.9
Prescription or over the counter drugs?	52.9*	8.8	29.4	47.1	23.5
Immunizations or vaccinations?	67.6*	8.8	32.4	26.5	20.6
How to quit smoking?	5.9	14.7*	11.8	11.8	82.4
Problems with drugs or alcohol?	2.9	14.7	14.7	47.1*	50.0
Depression, anxiety, stress, or mental health issues?	17.6	14.7	23.5	64.7*	32.4
Environmental health hazards?	2.9	11.8	5.9	55.9*	35.3
Sexual health?	35.3	32.4	32.4	76.5*	17.6
A particular doctor or hospital?	17.6	17.6	29.4	44.1*	44.1
Health insurance?	14.7	0.0	38.2*	20.6	50.0
Medicare or Medicaid?	5.9	5.9	8.8	20.6*	70.6
Dental health?	35.3	11.8	44.1*	26.5	35.3

Note. Percentages may not add up to 100% because respondents were able to mark all that apply.

\*Source visited most frequently for that health topic.

unprotected sexual intercourse emergency contraception can be taken by a woman to prevent pregnancy" ( $M = 103.5$  seconds,  $SD = 50.2$ ). Table 3 summarizes, for each scenario, the percentage of students finding the correct answer, and the mean number of seconds and number of clicks needed to find an answer.

More than three quarters of the students (76.5%,  $n = 26$ ) overlooked a correct answer at least once during the 12 scenarios. In terms of the Web sites on which answers were retrieved, dot com (.com; an Internet domain name for corporate or business Web sites) sites were the major source of answers in 6 scenarios, whereas dot org (.org; an Internet domain name traditionally reserved for non-profit Web sites) sites were the major source of answers in 2 scenarios. A US government-sponsored Web site (<http://www.cdc.gov/std/hpv/STDFact-HPV-vaccine.htm>) was a major answer source for only 1 scenario. Almost one

third (32.4%) of students searched Wikipedia, the online user-driven encyclopedic reference, to find an answer.

### Qualitative Themes

The "talking out loud" data revealed much about students' online sexual health search processes. Five qualitative themes emerged from these data: (1) using Google as a search tool; (2) utilizing Wikipedia as a source of credible sexual health information; (3) determining Web site reliability/credibility; (4) students' expressions of frustration during searches; and (5) issues regarding lack of sexual health literacy. Each of these themes will be discussed and illustrated below.

### Using Google as a Search Engine

As mentioned previously, the students in the current study literally "Googled" their sexual health questions, with 94.1% using Google as their main search tool. One male student who

**TABLE 2. Percentage of Students Reporting Ever Asking About or Looking for Sexual Health Information From 4 Sources (N = 34)**

Sexual health topic	% of students seeking information from physician/health care provider	% of students seeking information from a friend	% of students seeking information from a relative (including parent)	% of students seeking information online	% of students never looking for this information from any of these sources
Sexually transmitted infections, including HIV?	23.5	26.5	35.3	70.6*	23.5
Human papillomavirus and/or the HPV vaccine?	44.1*	26.5	32.4	38.2	41.2
Preventing pregnancy?	32.4	29.4	44.1	52.9*	26.5
Contraceptives?	41.2	29.4	32.4	50.0*	26.5
Emergency contraception?	14.7	11.8	2.9	32.4*	52.9
Abortion?	5.9	14.7	20.6	44.1*	41.2
Male or female genitalia?	2.9	14.7	11.8	58.8*	41.2
Normal sexual behavior?	11.8	23.5	17.6	44.1*	47.1
Prescription drugs and sexual health?	26.5	20.6	26.5	41.2*	47.1
Alcohol and/or illicit drug use and sexual health?	5.9	32.4	8.8	41.2*	50.0
Sexual assault and/or rape?	2.9	23.5	11.8	35.3*	52.9
Drug-facilitated rape?	8.8	14.7	14.7	38.2*	55.9

Note. Percentages may not add up to 100% because respondents were able to mark all that apply.

\*Source visited most frequently for that sexual health topic.

**TABLE 3. Percentage of Students Finding Correct Answers, and Time and Work Required to Locate Answers to 12 Sexual Health Scenarios (N = 34)**

Scenario	% finding the correct answer	Mean no. of seconds to find answer (SD)	Mean no. of clicks (SD)
1. Who can receive the HPV vaccine?	70.6%	133.1 (105.8)	5.7 (6.5)
2. Which STI can be passed through oral sex?	88.2%	134.6 (181.9)	4.9 (7.6)
3. Where can one get an anonymous HIV test in the local metropolitan area?	50.0%	141.7 (150.1)	6.2 (7.4)
4. What type of condom can be used if one has a latex allergy?	76.5%	113.9 (74.8)	4.2 (3.0)
5. What kind of abortion can one get at 4 weeks gestation?	73.5%	131.3 (80.7)	4.5 (3.9)
6. How long after sex can EC be used to prevent pregnancy?	100.0%	103.5 (50.2)	4.1 (2.1)
7. Can one get pregnant during the placebo week of BC pills?	82.4%	315.9 (259.1)	8.6 (8.9)
8. What is the average length of an adult erect penis?	91.2%	146.4 (91.8)	5.4 (4.3)
9. Can antidepressants decrease sex drive?	97.1%	163.2 (15)	5.7 (4.8)
10. What is the phone number for the campus safety escort service?	82.4%	212.8 (219.8)	13.3 (11.4)
11. What is a way alcohol can impact sexual decision making?	88.2%	224.5 (149.7)	7.0 (6.0)
12. Where can one get after-rape care/support in the local metropolitan area?	85.3%	317.8 (341.0)	15.3 (18.6)

began all of his searches at Google explained: “Google, because it searches literally everything in the world.” Many students shared that they always use Google because it’s the most comprehensive search engine. Other students touted Google’s ability to navigate and search within organizational Web sites better than the Web sites’ own internal search engines. For instance, a male student searching his university Web site for the campus safety escort service phone number (scenario 10) decided to leave the Web site and search on Google instead, stating: “I guess I’ll try to ‘Google it’ that way I can find more specific information than having to sort through all of this.” The students who used Google in this specific scenario were often quicker and more successful in finding an answer than students who searched the institutional site, especially if they knew the name of the campus safety escort service.

In a few instances, students found an answer to a scenario directly in the abstract produced by Google and, therefore, never even visited a Web site providing health information. One of the scenarios (no. 3) for which this occurred asked students to “find an anonymous HIV testing site in the local metropolitan area.” The Google Maps service actually provided a map, address, and phone number for the county health department site providing free, anonymous HIV testing. A female student who used this Google search result as her answer exclaimed: “Yeah, so Google was very good! It did the work for the Web sites. Good job! And, yeah I would just recommend to a friend go ahead and type that on Google and you’ll find it. It’s pretty cool!”

### Using Wikipedia as a Source of Credible Sexual Health Information

The second emergent theme concerned the use of Wikipedia (<http://www.wikipedia.org/>) as a credible source of online sexual health information. Wikipedia is a free, multilingual, online encyclopedia project. Unlike encyclopedias with which we are traditionally familiar, such as *Encyclopedia Britannica*, Wikipedia is written collaboratively by its volunteer online users, meaning that anyone has the ability to create and edit Wikipedia entries. In the current study, Google frequently produced a Wikipedia link within the first 10 search results, and almost one third of students followed one of these links.

Although most students appeared to be aware of the process by which Wikipedia entries are created and edited, students expressed a range of attitudes: from Wikipedia being a credible and even “final source” of information, to using Wikipedia cautiously, to completely avoiding Wikipedia even when the needed information was in the abstract. Several students shared that they often utilize Wikipedia as a source of information for class assignments. One male student, in search of whether antidepressants can decrease a person’s sex drive (scenario 9), followed a Google-produced Wikipedia link and claimed: “Wikipedia, my, like, final source if I ever wanna find something.” Other students were more cautious Wikipedia users. A female student searching for a type of

condom for someone with latex allergies (scenario 4) followed Google’s third ranked search result to Wikipedia and stated: “I’m going to Wikipedia, ‘cause sometimes it can be a valid source of information . . . but you have to be careful.” The young woman found an answer in Wikipedia’s condom entry in just over 2 minutes with only 3 clicks. Although several students acknowledged credibility issues associated with Wikipedia, only a single Wikipedia user was observed verifying the information provided by following and examining the reference links.

Among the non-Wikipedia users, the online encyclopedia’s participatory process of knowledge creation and information sharing was called into question. One female student succinctly stated: “Definitely don’t wanna use Wikipedia, ‘cause everyone knows that’s kinda iffy. There anybody can change what they want.” Another female student, searching via Google for a type of STI that can be passed through oral sex, went so far as to avoid Wikipedia even when the needed information was clearly in the Google abstract: “Well, the third result kinda has the answer, like has the question straight up, and I guess the answer’s on it, but it’s on, like, Wikipedia, and that’s not a very good site because you can just type stuff in yourself and fix things.”

### Web Site Reliability/Credibility

The third emergent theme identified was Web site credibility—that is, whether students considered a Web site to be trustworthy or accurate and how students arrived at this conclusion. As reported previously, very few students in the current study reported that they either always (3.7%) or most of the time (7.4%) look to see when the information on a health Web site was last updated or reviewed. Instead, students often cited a Web site’s domain name—dot com, dot gov, or dot orgs—as an indicator of its reliability/credibility. In particular, dot orgs and dot gov were considered to be more reliable/credible sources of online information. Yet, these sites were the major sources for answers in only 3 of the 12 scenarios. For example, a male student searching on Google for who can get the HPV vaccine (scenario 1) followed the first search result, a dot gov, and stated: “The first hit that popped up looks good ‘cause it’s a government site.” Another male student searching for an anonymous HIV testing center in the metropolitan area explained his preference for a dot org site: “Clicking the first site it’s a dot org, and they usually offer helpful information.” The Web site he selected ([www.gcjfs.org/svc-aidsnetwork.htm](http://www.gcjfs.org/svc-aidsnetwork.htm)) detailed the HIV/AIDS services provided by the Tampa Bay Aids Network (TBAN), a service of the Gulf Coast Jewish Family Services and included weekly anonymous HIV testing. Although for this student the Web site’s designation as a dot org indicated reliability/credibility, for another student the TBAN’s affiliation with the Gulf Coast Jewish Family Services raised concerns about reliability/credibility. When asked why she had decided to leave the Web site, even though it seemed to provide the needed information, she explained: “Because, first off, like, the title kinda throws me off a

little bit. I'm not against Jews. I'm part Jewish too. But, like, they're saying how it's just the Gulf Coast Jewish Family Services. It's like kinda narrowing it all down. And, then the more you read down the ad's giving, like, for more assistance and information you can call there, but we're kinda looking for anonymous HIV testing, but if you're calling about it, it wouldn't be all anonymous then." It is interesting to note that this student considered calling a phone number for further information a *nonanonymous* activity. It could be speculated that, with the pervasiveness of caller identification today, making a phone call no longer is the anonymous activity it once was.

In a few instances, students visited directly known Web sites they considered to be reliable/credible. For example, one female student, searching for how long after unprotected intercourse emergency contraception can be used to prevent pregnancy, clearly stated: "I went to Planned Parenthood because I find that is has more reliable information, and I went and looked up the morning after pill and it says it must be taken within 120 hours of unprotected intercourse." A few students verified the reliability/credibility of Web sites by examining the source of the information. In the process of searching for the average length of an adult erect penis, students frequently encountered Web sites of questionable reliability/credibility. Although most students did not verify the questionable information provided, some students did verify the source of the information, the author, or the study that produced the results, as one male student illustrated: "I had some trouble finding the answer. There's a lot of unbelievable Web sites, but this one says it's a study of the Journal of Urology and it seems to be pretty good."

### Expressions of Frustration

The fourth emergent theme was frustration. During the search process, many students verbally and physically expressed frustration while trying to find answers to the sexual health scenarios, a finding echoed in the questionnaire data, with 25.9% of participants reporting that they felt frustrated during their most recent online search. Most expressions of frustration occurred while students were searching for local sexual health resources, such as "where someone can get an anonymous HIV test" and "where someone can get after-rape care and support" in the local metropolitan area. The quantitative findings also reflected this frustration. For instance, as pointed out previously, only half of students accurately reported an anonymous HIV testing site in the local metropolitan area. Further, finding "where someone can get after-rape care and support" required the most amount of time and work of any of the 12 scenarios; this was the only scenario in which students actually *gave up* on trying to find an answer. One student, after questioning the reliability of a Web site only to return to it after an extensive search elsewhere, stated: "I'm gonna go with... I found the answer, 'cause I am getting frustrated. Sooo, whatever." With regards to finding "where someone can get after-rape care and support," a great deal of verbal frustration was demonstrated by students. Another

female student, who thought she had finally found a local resource for rape victims but instead had found a forum for crime victims, exclaimed: "It's a forum. Oh, my God! This is annoying!" After 37 clicks and 6 minutes, 43 seconds of searching, a frustrated and even angry male student resigned himself and stated: "I give up. I quit. My friend will just have to be raped and she'll get over it."

### Issues Regarding Lack of Sexual Health Literacy

The final theme that emerged pertained to issues of sexual health literacy. *Healthy People 2010*<sup>19</sup> identified improved consumer health literacy as a key objective and defined health literacy as: "The degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions." The "talking out loud" data revealed many instances of poor sexual health literacy, which greatly impaired students' ability to digest and comprehend basic sexual health information. For example, when searching for a type of STI that can be passed through oral sex, one male student understood *STDs* to be something completely different from *STIs*. Reading the first Google search result, he stated: "Myths and misconception about, oh, that's STDs and I want STIs." Another male student, searching for the same answer, encountered a basic sexual health term: vaginal intercourse. This student asked himself out loud: "When they mean vaginal intercourse does that mean two of them touching each other?" He then proceeded to "Google" vaginal intercourse, which demonstrated his ability to utilize the Internet as a tool for increasing his sexual health literacy. In another example, a female student began her search for "what type of abortion can one have at 4 weeks" (scenario 5). This young woman personalized the sexual health scenarios through the talking aloud process and, in this instance, inaccurately anticipated the information she might find while using the name of the person in the scenario: "So, I need to find... I want to find... I'm going to be looking for a type of abortion that Amy can have since it's only 4 weeks. So, let's see. Umm... abortions... early abortions? It's probably gonna give me Plan B or something." As revealed through her talking out loud, this student was clearly misinformed about what constitutes an early abortion method; she considered Plan B—the brand name of an emergency contraceptive pill that can be taken used up to 120 hours after sexual intercourse—to be an abortifacient.

### COMMENT

Most students who participated in this study found accurate online answers to the 12 sexual health questions posed. Finding local information and resources online proved more difficult for students to locate than finding answers to general sexual health questions, however. Three scenarios—"Where can one get an anonymous HIV test in the local metro area?", "What is the phone number for campus safety escort service?", and "Where can one get after-rape care/support in the local area?"—were the most time-consuming scenarios,



requiring more work for students to locate answers. Feelings of frustration were apparent and common among students during these information searches. Several students became so frustrated with their inability to navigate Web sites or locate answers that they stopped the search completely. Many students searching their university Web site to locate the phone number for the institution's safety escort service also became so frustrated with the site's internal search engine that they pointed their Internet browser to Google to conduct the search.

The fact that "Google it" has become a part of the American lexicon demonstrates the search engine's social and cultural capital. In the United States, Google (<http://www.google.com/>) is the most commonly used search engine, receiving 58.4% of all queries in December 2007 compared to the next most popular search engine Yahoo (<http://www.yahoo.com/>), which received 22.9% of all queries for the same month.<sup>29</sup> A recent article by Pan and colleagues<sup>30</sup> examined college students' use of Google through an eye-tracking experiment and found that these users had substantial trust in Google's ability to rank results by their true relevance to the query, so much so that they consistently selected links in higher positions even though they were *less relevant* to the queries. As found by Pan and colleagues,<sup>30</sup> the college students who participated in the current study also demonstrated faith in Google's ability to search everything and find the most relevant and specific information. In many cases, by retrieving results more efficiently than Web sites' internal search engines and by even providing answers in the search results, Google proved itself to be worthy of such trust. Nevertheless, Google rarely produced search results containing known, credible sexual health Web sites such as [www.itsyoursexlife.com](http://www.itsyoursexlife.com) and [www.sexetc.org](http://www.sexetc.org).

Rather than going directly to trusted health and sexual health information Web sites, students in the current study "Googled" their scenarios and then filtered the search results based on Web sites' perceived credibility. Students' use and nonuse of Wikipedia is one illustration of such filtering. As almost one third of students searched Wikipedia to find a scenario answer, students expressed a range of opinions regarding the site—from it being a credible and even "final source" of information, to using the online user-driven encyclopedic reference cautiously, to completely avoiding the Web site altogether. At colleges and universities across the United States, students' reliance on Wikipedia as a credible and citable reference has raised concerns.<sup>31</sup> However, a recent *Nature* study<sup>32</sup> indicated that Wikipedia's science-specific entries are somewhat comparable—in terms of the number of serious and factual errors, omissions, and misleading statements—to the same entries in *Encyclopedia Britannica* (although *Encyclopedia Britannica* has disputed this finding<sup>33,34</sup>).

Other than students' comments about Wikipedia, we found that students' opinions varied greatly in terms of what constitutes a reliable Internet source. Students' remarks about Web site reliability/credibility reflected their perceptions of certain source characteristics, such as Web site domain (.org,

.com, and .gov). For instance, whereas one student noted a site "[looked] good 'cause it's a government site," another student noted .org sites "usually offer helpful information." At the risk of stating the obvious, such global reasoning that dot org (or dot com) Web sites are generally reliable or trustworthy is problematic. Students in this study visited a broad representation of dot org Web sites, from national organizations, such as the Planned Parenthood Federation of America and BACCHUS Network, to the relationship help and advice Web site, [dearcupid.org](http://dearcupid.org). Students also visited an array of dot com Web sites, from the general (About.com and Answers.com) to health specific (*WebMD*, [MayoClinic.com](http://MayoClinic.com), and [coolnurse.com](http://coolnurse.com)) to health content specific ([Durex.com](http://Durex.com) [the condom maker], [AbortionFacts.com](http://AbortionFacts.com), and [DrEmily.com](http://DrEmily.com)). The reliability of information provided on these Web sites is unknown and, thus, additional research may be warranted (given the fact that there is neither universal agreement pertaining to online health information standards nor regulation of health information provided over the Internet, although we are not advocating for the latter).

In a study of college students' perceptions of information credibility and verification behavior, Metzger et al.<sup>35</sup> reported that college students find information online to be more credible than do those from a more general adult population, and college students tend to verify the information they find online *significantly less often*. According to the authors, the most frequent verification strategies used by students are checking to see if the Web site information is current, complete, and comprehensive, considering whether the views represented by the author are facts or opinions, seeking out other sources to validate online information, and considering the author's goals or objectives in posting information to the Web, whereas less-often used strategies include checking to see who the author is, looking for a stamp of approval or recommendation for the site, making sure contact information is provided by the author, and verifying the Web site author's qualifications or credentials. In our study, approximately half of students reported that they either *never* or *hardly ever* look to see when the information on a health Web site was last updated or reviewed by a medical professional, and few students reported that they either *always* or *most of the time* look to see when the information on a health Web site was last updated or reviewed.

### Limitations and Future Directions

We found Camtasia to be a highly unobtrusive tool to observe research participants' Web search behaviors. However, this study is limited by the fact that a researcher also observed students during their searches, and this may have made student participants uncomfortable, given the sensitive nature of the material. Additionally, although we deemed "talking out loud" through what students were doing to be an important feature of this study (so that the reasons behind their search behaviors could be analyzed and understood), this may have slowed students' searches and contributed to feelings of discomfort during the searches. This study is

further limited by its focus on first-semester, first-year undergraduate students. Because young people are the early adopters of technology, future research is needed which examines how younger adolescents—that is, middle and high schoolers—access sexual health information online. Finally, this study is limited by its dependence on technology to record online health information searches. For instance, for unknown reasons, in a few of the scenarios, audio in the Camtasia recordings for 2 students was partially lost. We suggest researchers of future observational studies employing Camtasia Studio also use a secondary recording device as a back-up method. Finally, the manner in which we elicited information for the scenarios (i.e., asking health educators and health care providers what sexual health questions are being asked by young people) may serve as a limitation. Because young people go online seeking answers to potentially embarrassing sexuality-related questions, the questions we received from our panel of professionals may not accurately reflect the most uncomfortable topics that lead students directly to the Internet.

Although most students who participated in this study found accurate online answers, research is sorely needed on the quality of these answer Web sites. Questions remain about the characteristics of the Web sites on which students find answers. For instance, do visited Web sites meet established criteria for the deployment of useful and reliable online health information and do these Web sites adhere to ethical guidelines for e-health<sup>36,37</sup> or Health on the Net principles<sup>38</sup>? Further, students may have retrieved the correct answers on Web sites, but do these sources also contain misinformation?

Lastly, many helpful sexual health Web sites have been created specifically with young people in mind. Examples include heavily advertised Web sites maintained by media companies such as MTV/Viacom (<http://itsyoursexlife.com/>), university-based Web sites (<http://www.goaskalice.columbia.edu/>), and sites made explicitly for teens (<http://sexetc.org/> and <http://www.iwannaknow.org/>). However, students participating in this study rarely visited these sites or many other trusted health Web sites to locate sexual health information online. Practical questions linger regarding how young people can be directed to these useful information sites. Because Google is such an indispensable search tool for this generation of college students, one area for further investigation is search engine optimization (SEO), “the process of identifying factors in a webpage which would impact search engine accessibility to it and fine-tuning the many elements of a Web site so it can achieve the highest possible visibility when a search engine responds to a relevant query” (p. 666).<sup>39</sup> Although an in-depth discussion of SEO is beyond the scope of this paper, this is a particularly important topic seeing as most search engine visitors do not scan much beyond the initial page of search results,<sup>30</sup> a finding mirrored in our study. Our findings highlight the importance for local and regional organizations to rethink their allocation of limited resources in developing and maintaining health Web sites. Because our students had difficulty finding local health information and resources

online, at a minimum, we recommend these organizations investigate options for improving their Web sites’ visibility through SEO.

## Conclusions

Based on this and other research,<sup>27</sup> it has become clear that college students are not only frequent Internet users, but they also rely heavily on search engines such as Google to locate sexual health information online. Furthermore, reflecting research conducted by Pan and colleagues,<sup>30</sup> this study documents that users of Web search engines do not scan search engine results for long. By and large, the students in this study who utilized a search engine selected and followed 1 of the first 3 search results, in addition to following sponsored links. It is important that training guides/tutorials and continuing education programs for parents and college staff are developed based on how online searches are conducted. Young people must be educated about how search engine results are prioritized and displayed. Further, because the Internet has become the leading source for sexual health information, the critical thinking skills involved in the evaluation of Web sites for reliable information must be made a priority.

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## NOTE

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