REFERENCES
Linked references are available on JSTOR for this article:
http://www.jstor.org/stable/40221408?seq=1&cid=pdf-reference#references_tab_contents
You may need to log in to JSTOR to access the linked references.

Characteristics Associated With Use of Public and Private Web Sites as Sources of Health Care Information

Results From a National Survey

Edward Alan Miller, PhD, MPA,*†‡§ and Darrell M. West, PhD*‡

Objective: We sought to determine the frequency with which Americans access health information from governmental (public sector) and nongovernmental (private sector) web sites and to identify similarities and differences in the characteristics associated with use of each type. **Methods:** Data derive from 928 individuals who responded to a November 2005 national survey. In addition to forms of health communication, we asked about age, gender, race, income, education, insurance, lifestyle, residence, satisfaction, literacy, and health. We report the extent of web site use stratified by sponsorship type—public and private. We also use χ^2 tests to examine bivariate associations. Logistic regression and multiple imputation of missing data were used to examine the correlates of use in a multivariate context. **Results:** More than twice as many respondents visited private web sites (29.6%) than public web sites (13.2%). However, just 23.6% and 18.9% of private and public web site visitors, respectively, reported doing so once a month or more. Both public and private web site visitors were more likely to be better-educated respondents (odds ratio [OR] = 0.83, OR = 1.57) reporting greater concerns about health care access (OR = 1.28, OR = 1.20) than nonvisitors. Younger individuals (OR = 0.83) living in urban areas (OR = 1.59) with stronger health literacy (OR = 1.24) and reporting greater concerns about health care affordability (OR = 1.59) were more likely to visit privately sponsored web sites but nonpublicly sponsored ones. **Conclusion:** Relatively low utilization levels necessitate a concerted effort to improve the quality, accessibility, and relevance of Internet health information. Efforts to close the digital divide must recognize differences in user characteristics across governmental and nongovernmental web site providers.

Key Words: e-health, Internet, digital divide, ownership, health information

(Med Care 2007;45: 245–251)

From the *A. Alfred Taubman Center for Public Policy and American Institutions; †Departments of Community Health and ‡Political Science; and the §Center for Gerontology and Health Care Research, Brown University, Providence, Rhode Island.
Reprints: Edward Alan Miller, PhD, MPA, A. Alfred Taubman Center for Public Policy and American Institutions, Brown University, 67 George Street, Box 1977, Providence, RI 02912. E-mail: edward_a_miller@brown.edu.

Few developments have had broader ramifications for health and medicine than the spread of digital technology. With the rise of the Internet and the subsequent utilization of electronic transmissions, policymakers view health information technology (HIT) as a tool for improving quality, reducing costs, and coordinating care among providers and patients.[1] Use of the World Wide Web for health information, e-mail, diagnostic support, and electronic medical records (EMRs) are just a few of the functions being highlighted.[2,3] Although investment in HIT by providers has been slow,[4] estimated savings of $81 billion per year have been posited through adoption of EMR systems alone.[5] With the number of Americans using the health care Internet nearly doubling since 2000,[6] online materials have already begun to effect how people relate to health care personnel and make health and medical decisions.[7,8]

Despite the promise of digital technology, there has been relatively little empirical research regarding which people rely on electronic information resources.[6,7,9–12] Given varying levels in the documented performance of the public, commercial, and nonprofit sectors in health care,[13–20] in particular, it is important to look at web site use by sponsorship status. Are there differences in utilization between governmental (public sector) and nongovernmental (private sector) web sites? What implications do these differences have for the digital divide? Because private sector sites are often sponsored by for-profit entities such as medical equipment and pharmaceutical manufacturers, they run the risk of real or perceived conflicts of interest. In addition, because there may be differences in background between those who rely on public versus private sites, differences in utilization have ramifications for how society overcomes the gap between electronic haves and have-nots. To better understand the relationship between web site use and sponsorship status, we use national public opinion survey data to examine variations in public and private web site use and the characteristics of individuals reporting use of each.

METHODS

Sample and Data Source

This study is based on a national public opinion survey of 1428 adults 18 years or older in the continental United States. Data collection took place from November 5 to 10, 2005, at a university polling organization with trained and paid interviewers. We asked respondents about forms of

health care communication, satisfaction with health services, knowledge levels, and lifestyle behaviors. We also asked for basic demographic information, including age, gender, race, insurance status, education level, residence, income, and perceived health. The sample was provided to the authors by a commercial sampling firm. It was based on a randomly-generated set of telephone numbers stratified by state to ensure proper geographic representation. It had also undergone prior screening using automated methods to ensure the inclusion of working numbers. The margin of error in this survey was plus or minus 3 percentage points. Up to 3 callbacks were placed to reach prospective respondents. Of 3725 eligible households in our initial sampling frame, 1428 answered the telephone, including 928 who completed the survey. Thus, we received responses from approximately 25% of all eligible households and 65% of households contacted.

Outcome Measures: Web Site Use

Respondents were asked how often in the past year they had visited a government- or privately sponsored web site. Specific categories included: "not at all," "every few months or less," "once a month," and "once or more a week." In addition to identifying the frequency with which respondents accessed each type of site, we coded each variable dichotomously indicating those who did and did not visit a particular type of site during the previous year.

Covariates: Respondent Characteristics

Conceptualizing communication behavior as a form of utilization, we organize the predictors of web site use according to Andersen's behavioral model of health services, which posits that health behaviors are a function of predisposing, enabling, and need characteristics.[21] We measure need—or one's state of health or illness—by asking respondents to rate their current health as "very poor," "poor," "fair," "good," "very good," or "excellent."[22] We measure enabling characteristics, or indicators of personal/family and community resources, using insurance status (uninsured, insured), income (0–$15,000, $15,001–$30,000, $30,001–$50,000, $50,001–$75,000, $75,001–$100,000, $100,001–$150,000, $150,001+), and place of residence (rural, urban/suburban).[23]

We measure predisposing characteristics using demographic, social structure, and health belief indicators. Demographic factors include age (18–24, 25–34, 35–44, 45–54, 55–64, 65–74, 75–84, 85+) and gender. Social structure includes education (0–8 years, some high school, high school graduate, some college, college graduate, postgraduate work) in addition to ethnicity (non-Hispanic white, black, Hispanic, Asian-American, something else), the latter of which we collapse into 2 categories, non-Hispanic white versus other. We measure values toward health and disease using reported frequency of 3 lifestyle behaviors: smoking, exercising, and eating a balanced diet. We used 5-point scales running from "not at all" to "every meal"/"several times a day." As a result of a lack of variation, smoking was coded dichotomously. We measure health literacy, which has been defined 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,"[24] using 3 spe-

cially designed survey items—confidence filling out forms, requiring help reading materials, and difficulty understanding written information.[25] Because principle component analysis confirmed the relatedness of all 3 items, we used the average of all 3 to create the overall index used (Cronbach alpha = 0.61).

To measure respondent attitudes toward health services, we rely on 9 items modified from the short-form Patient Satisfaction Questionnaire (PSQ-III).[26] These items include questions regarding health care affordability, access, and quality. Like with health literacy, principal components analysis was used to examine the consistency of these 9 items as indicators of respondent attitudes. As expected, results revealed 3 distinct factors reflecting 3 very different underlying concepts. The first factor included 2 questions about affordability: worry about affording health care ("very worried," "somewhat worried," "not very worried") and problems paying medical bills ("yes," "no"). The second factor 2 questions about access: difficulty getting appointments and ability to get medical care whenever needed. The third factor 5 questions about quality: doctors hurrying too much, providing complete care, making correct diagnoses, careful to check everything, and acting too businesslike/impersonal. Questions about access and quality were measured using 5-point Likert scales with response categories ranging from "strongly agree" to "strongly disagree." We used the average of the individual items measuring respondent attitudes toward access and quality to create the overall indices for these concepts (alphas = 0.64 and 0.70, respectively). We did the same to generate the overall index for affordability, although, because the 2 items were based on different scales, we first standardized them around their means before taking the average (alpha = 0.57).

Analysis

Analysis proceeded in multiple steps. First, we identified the percentage of respondents visiting public and private sector web sites. Second, we used χ^2 tests to examine bivariate associations between web site use and respondent characteristics and attitudes. Third, we used logistic regression to estimate adjusted odds ratios describing the relationship between web site use and the independent variables of interest. For purposes of this latter analysis, we used multiple imputation of missing data. The number of missing values ranged from only 3 to 81 for all variables but income in our data set. At 222, or 23.9%, however, a significant portion failed to report income. This is common in social research with nonresponse on family income typically ranging from 15% to 30% or higher.[27] Whereas complete case analysis can lead to undesirable reductions in sample size and to biased estimates if the subjects included in the analysis differ systematically from the subjects excluded because of missing data,[28,29] single imputation fails to account for uncertainty associated with making predictions about unknown missing values, thereby resulting in potentially invalid inferences.[30] This is in contrast to multiple imputation, which, by replacing each missing value with a set of plausible values, does account for such uncertainty and has, therefore, been suggested as an especially effective and preferred way of improving the usability of health survey data[30,31] even when 20% to 30% or

246

more of the data are missing.[29–31] Here, we used the Markov Chain Monte Carlo method to create 20 complete data sets by replacing missing values with simulated values with variation across these completed data sets reflecting the uncertainty resulting from imputation.[28] Following expert advice,[31,32] all variables subsequently used in our analysis models were included in our imputation model, which we implemented using PROC MI in SAS 9.1. Next, we separately analyzed each of the 20 complete data sets using logistic regression. Results from these 20 analyses were subsequently combined using PROC MIANALYZE to produce single parameter estimates, their estimated standard error, and valid statistical inferences.

RESULTS

Results indicate that approximately 13.2% of our sample visited a government-sponsored web site for health care information during the previous year (Table 1). This is as compared with 29.6% who reported visiting a privately sponsored site. Few reported accessing either publicly or privately sponsored web sites more than a handful of times during the course of the year. Thus, only 23.6% and 18.9% of private and public web site visitors, respectively, reported doing so once a month or more.

In general, we find significant differences in web site use based on age, gender, attitudes, education, lifestyle, literacy, locality, income, and health (Table 2). Younger females with better educations, higher incomes, and more negative attitudes toward health care access were more likely to report visiting both public and private sector web sites than less well educated older males with lower incomes and more positive attitudes toward access (all $P < 0.05$). Respondents with more negative attitudes toward health care quality were also more likely to visit both government web sites ($P < 0.05$) and private web sites ($P < 0.10$). This is also true of respondents with more negative attitudes toward health care affordability, although results did not achieve statistical significance ($P > 0.10$). Whereas respondents with occasional or daily exercise regimes ($P < 0.05$), stronger health literacy ($P < 0.05$), urban/suburban residences ($P < 0.05$), and better perceived health ($P < 0.10$) were more likely to visit private sector web sites, they were neither more nor less likely to visit publicly sponsored ones. No significant associations could be identified between any form of web site use and race, balanced diet, smoking, and insurance status.

Table 3 reports combined results from 20 logistic regression models predicting use of each type of web site. The

TABLE 1. Variation in Use of Public and Private Web Sites

	Public Sector Web Site	Private Sector Web Site
Not at all (%)	84.9	66.6
Every few months or less	10.7	22.6
Once a month	1.3	4.5
Once or more a week	1.2	2.5
Total using	13.2	29.6

Source: National Public Opinion E-Health Survey, November 5–10, 2005.

models fit the data very well as indicated by strongly significant -2 log likelihoods (all $P < 0.001$), average pseudo R^2 in the 0.103 to 0.176 range, and c-statistics in the 0.699 to 0.731 range. We found that although older respondents were neither more nor less likely to visit government web sites, they were less likely to visit private sector sites (odds ratio [OR] = 0.83, confidence interval [CI] = 0.75–0.91). This is in contrast to better educated respondents, who were more likely to seek information from both public and private sector web sites (OR = 1.53, CI = 1.29–1.80; OR = 1.57, CI = 1.37–1.80). This is also true of respondents with more negative attitudes toward health care access, who were more likely visit both publicly and privately sponsored web locations as well (OR = 1.28, CI = 1.01–1.62; OR = 1.20, CI = 0.99–1.44). Whereas respondents with more negative attitudes toward health care affordability were more likely to visit private sector sites (OR = 1.25; CI = 1.00–1.56), they were neither more nor less likely to visit public sector ones. There is also evidence to suggest a relationship between stronger health literacy and urban or suburban residency and the probability of visiting a private sector web site (OR = 1.24, CI = 0.98–1.57; OR = 1.59, CI = 1.11–2.27) but not a publicly sponsored one. No significant associations could be identified between use of public web sites or private sector web sites and gender, race, insurance status, income, self-perceived health, lifestyle (exercising, smoking, and eating), and attitudes toward health care quality.

DISCUSSION

The Internet is altering how people consume health care, the way in which they obtain information and the manner in which they evaluate alternatives. Depending on where they acquire information, however, there are implications for the quality of consumer knowledge and the ability of technology to improve health care. With significant differences in how various web sites function, and national estimates indicating that 50% to 80% of adult Internet users search for health information and advice online,[6,7,9,11,12] it is crucial that where consumers go be identified. Our results indicate that the percentage of respondents visiting private web sites (29.6%) was more than twice the percentage visiting public sector web sites (13.1%). We also found differences in the characteristics of public and private web site users. On the one hand, logistic regression findings indicate that better educated respondents with more negative attitudes toward access were more likely to report visiting both publicly and privately sponsored sites than less well educated respondents with more positive attitudes toward health care access. On the other hand, they indicate that younger respondents living in urban areas with stronger health literacy and more negative attitudes toward affordability were more likely to visit privately sponsored web sites. No relationship could be identified between age, health literacy, and attitudes toward affordability and government-sponsored web site use.

Multivariate analyses of previous web site surveys found positive relationships between seeking health information over the Internet and the following: being female,[6,7,9–12] younger,[7,10,12,33] better educated,[7,10,12,33,34] living in urban/

TABLE 2. Variation in Use of Public and Private Sector Web Sites by Subgroup

	Public Sector Web Site	Private Sector Web Site
Age		
18–44 (%)	13.6	37.3
45–64	18.4	35.9
65+	5.9	13.4
	17.2 (2) $P < 0.0001$*	38.9 (2) $P < 0.0001$
Gender		
Male (%)	9.1	25.6
Female	16.2	34.2
	9.1 (1) $P = 0.003$	7.3 (1) $P = 0.007$
Race		
White (%)	13.8	32.0
Nonwhite	13.0	28.1
	0.1 (1) $P = 0.809$	0.9 (1) $P = 0.342$
Education		
0–11 years (%)	5.1	6.4
12 years	5.8	15.9
13–16 years	15.5	40.4
17+ years	28.9	50.0
	45.8 (3) $P < 0.0001$	86.1 (3) $P < 0.0001$
Cost perceptions		
Positive (%)	14.3	30.8
Moderate	10.4	27.7
Negative	16.0	37.1
	2.1 (2) $P = 0.349$	3.4 (2) $P = 0.184$
Access perceptions		
Positive (%)	11.2	28.1
Moderate	14.6	34.9
Negative	24.3	39.8
	13.7 (2) $P = 0.001$	7.6 (2) $P = 0.023$
Quality perceptions		
Positive (%)	8.9	29.1
Moderate	15.5	30.8
Negative	16.4	42.3
	7.2 (2) $P = 0.027$	4.6 (2) $P = 0.098$
Exercise		
Not at all (%)	11.9	22.6
Occasionally	16.5	36.4
Daily	11.7	29.8
	4.1 (2) $P = 0.128$	10.0 (2) $P = 0.007$
Balanced diet		
Not at all (%)	9.5	23.3
Occasionally	12.6	28.8
Daily/every meal	14.2	32.6
	1.4 (2) $P = 0.495$	3.1 (2) $P = 0.211$
Smokes		
No (%)	13.7	31.8
Yes	11.9	27.8
	0.4 (1) $P = 0.513$	1.0 (1) $P = 0.313$
Health literacy		
Poor/fair (%)	7.3	14.6
Good	14.9	16.7
Very good	12.9	29.0
Excellent	14.1	35.6
	1.7 (3) $P = 0.643$	17.3 (3) $P = 0.001$
Income		
0–30,000 (%)	8.2	19.7
30–75,000	14.0	37.3
75–100,000	19.2	47.3
>100,000	29.8	47.2
	26.0 (3) $P < 0.000$	35.2 (3) $P < 0.001$
Health insurance		
No (%)	11.5	25.6
Yes	14.1	32.4
	0.6 (1) $P = 0.439$	0.2 (1) $P = 0.136$
Urban		
Rural (%)	11.3	24.4
Urban/suburban	15.0	35.2
	2.2 (1) $P = 0.137$	10.2 $P = 0.001$
Perceived health		
Very poor/poor (%)	11.9	21.1
Fair	12.3	24.2
Good	14.8	30.2
Very good	13.5	36.4
Excellent	13.0	31.9
	0.7 (4) $P = 0.952$	9.1 (4) $P = 0.059$

n varies, ranging from 679–907 depending on the number of missing values.
*χ^2 (df) P value.
Source: National Public Opinion E-Health Survey, November 5–10, 2005.

TABLE 3. Results of Logistic Regression Models of Web Site Use (public sector, private sector)

	Public Sector Web Site	Private Sector Web Site
>Age	0.90 (0.79–1.03)	0.83* (0.75–0.91)
Female	1.23 (0.95–1.59)	1.14 (0.89–1.47)
Nonwhite	0.93 (0.53–1.65)	0.85 (0.55–1.32)
>Education	1.53* (1.29–1.80)	1.57* (1.37–1.80)
<Cost perception	1.04 (0.78–1.38)	1.25‡ (1.00–1.56)
<Access perceptions	1.28‡ (1.01–1.62)	1.20§ (0.99–1.44)
<Quality perception	1.12 (0.82–1.53)	1.03 (0.80–1.32)
>Exercise	0.98 (0.86–1.12)	1.02 (0.92–1.13)
>Balanced diet	1.01 (0.88–1.15)	1.04 (0.94–1.16)
Smokes	0.98 (0.56–1.72)	0.90 (0.59–1.36)
>Health literacy	1.07 (0.79–1.43)	1.24§ (0.98–1.57)
Income	1.03 (0.95–1.12)	0.98 (0.82–1.05)
Health insurance	1.20 (0.61–2.34)	1.42 (0.84–2.40)
Urban	1.23 (0.78–1.94)	1.59‡ (1.11–2.27)
>Perceived health	0.88 (0.73–1.06)	0.97 (0.84–1.13)
Constant	0.01* (0.00–0.12)	0.02* (0.00–0.12)
Pseudo R^2	0.103 (0.095–0.110)	0.176 (0.165–0.186)
−2 log likelihood	665.90 (660.81–697.50)	983.41 (976.53–991.34)
c-statistic	0.707 (0.699–0.714)	0.723 (0.716–0.731)
n	910	893

*$P < 0.001$; †$P < 0.01$; ‡$P < 0.05$; §$P < 0.10$.
Note: Table reports odds ratios with 95% confidence intervals in parentheses. These derive from logistic regression models analyzed independently from 20 replicate data sets generated from multiple imputation combined using Proc MIANALYZE in SAS. Mean pseudo R^2, −2 log likelihood, and C statistics generated from the 20 replicate data sets are reported with minimum and maximum values in parentheses. Overall significance was consistent across all 20 models estimated for each dependent variable.
Source: National Public Opinion E-Health Survey, November 5–10, 2005.

suburban locations,[10] and having higher incomes.[10,33] Although not all of these relationships are reflected in the multivariate findings reported here (ie, gender and income), they are all reflected in the bivariate associations reported. Furthermore, like other nationally representative studies,[9–11] we failed to identify a significant relationship between web site use and race and ethnicity when controlling for other

© 2007 *Lippincott Williams & Wilkins*

potentially confounding factors such as age, education, income, and urban/rural location. This further lends credence to the conclusion that racial and ethnic differences in Internet use disappear after accounting for differences in income, education, and other socioeconomic characteristics. Indeed, the only nationally representative study to identify a significant relationship between web site use and race and ethnicity neglected to control for factors such as income on the right-hand side.[12]

Although unrelated to race and ethnicity, differentials in web site use based on education, literacy, and residence illustrate difficulties policymakers face in closing the digital divide.[35] On the one hand, results indicate that less well educated respondents exhibit a lower probability of accessing health information web sites of all kinds, implying the presence of a digital divide across the public and private sectors alike. On the other hand, results indicate that rural respondents with weaker health literacy were less likely to use private sector sites but neither more nor less likely to use public sector ones. This implies that although a digital divide exists, it may be stronger and more pervasive in the private sector where most information is written at a reading level well above that of many users[36] and high speed Internet access—located predominantly in urban areas—is more often necessary to fully take advantage of web site content.[37]

Differential rates of web site utilization favoring private web sites also raise important questions regarding the type and quality of the information being downloaded. Extant evidence indicates that not all health web sites are the same. Eysenbach et al[38] and others,[39–41] for example, demonstrate that health information web sites vary enormously in the validity of their information. Although the amount of online information has risen dramatically in recent years, there are few standards governing the provision of online materials, and some information is incomplete or inaccurate or is sponsored by vested interests with a financial stake in particular treatments. Although there have been few systematic studies of the quality or accuracy of viewpoints represented,[38–41] it stands to reason that private sector sites have the highest level of real or potential conflicts of interest owing to sponsorship, in part by pharmaceutical or other health care companies. Most public sector sites, for example, accept no commercial advertising nor offer products on a for-profit basis.[42]

Although our study does not directly address the nature of the information posted, the characteristics of users identified provide insights into several areas. That respondents with more negative attitudes toward health services were more likely to visit both government and private sector web sites supports the expectation that individuals with greater difficulty accessing and/or affording care are more likely to seek alternative sources of information, advice, and supplies online. That younger respondents were more likely to visit private sector web sites but neither more nor less likely to visit public sector sites implies that government web masters may be posting more relevant material to older age groups than private sector ones. At the time of the survey, Medicare Part D was nearing implementation, which may explain, in part, the findings reported here. Findings could also be explained, in part, by the progressive decline in computer literacy with age. On average, older individual have lower computer literacy than younger individuals. Indeed, compared with nonseniors, elders are much less likely to own a computer let alone have access to the Internet.[43] Consequently, when seniors use the Internet, they may be more likely to do so at a senior center or public library, which may be more inclined to steer them toward a public than private sector web site for certain services and information. This is in contrast to younger people, who, because they are more likely to access the Internet on their own, are more likely to rely on search engines such as Google, which is unlikely to show a predilection favoring some types of web sites over others. However, because most web sites are privately sponsored, it seems reasonable to conclude that younger respondents may be guided to a disproportionately larger number of privately sponsored web locations.

That younger people were more likely to visit private sector web sites but not government web sites is also interesting because they tend to be the most cynical about government in general and the bloc least likely to be engaged in the political process. As an age group, young people vote approximately 30% less frequently than do senior citizens.[44] This cynicism may extend to the Internet where younger groups may be more likely to trust nonpublic than public information sources. However, because private sector web sites may be more likely to show the greatest variability in content and to feature the most real or potential conflicts of interest, younger individuals may be at greatest risk of getting biased, one-sided, or incomplete health care information. Because most commercial sites do not flout their conflicts, unwitting consumers may take the information presented at face value, not recognizing that it is sponsored by an interested party seeking to guide them toward particular choices. This is reflected in Internet searches of almost any disease or condition, which quickly reveal a plethora of sites providing seemingly unbiased information but sponsored by pharmaceutical manufacturers presenting their own products in the best possible light.

Indeed, there are differences in information screening processes across governmental and nongovernmental web sites that have consequences for web site content. A number of government agencies have advisory boards of experts who provide feedback on agency decisions and information provision.[42] Although there is no guarantee that public sector information is always accurate, the fact that it goes through a screening process increases the odds of higher quality and more accurate information, except in highly politicized areas or when major differences of opinion exist among experts. Private sector sites, especially commercially sponsored ones, are more likely to vary in the kind of material provided because sponsors have incentives to promote products linked financially (or otherwise) to organizational interests. This notion is only speculative, however, and needs to be confirmed through future research.

There are also differences in web site visitors based on the types of marketing strategies used. Public sites are marketed to the general public with little differentiation based on

249

market segments. Although some material may be more relevant to some groups than others such as Medicare is, for example, to the elderly and permanently disabled, government officials do not target certain groups or emphasize niche marketing strategies.[42] In contrast, private sites sometimes follow "niche" strategies targeted at particular groups of people based on age, gender, race, income, interest, or other characteristic to match products, information, and services with potentially interested consumers. This may be especially true of for-profit web sites relative to non-profit sites. This is because, as Schlesinger and Gray[18] so aptly observe in the context of health care more generally, non-profit and for-profit ownership are distinct legal forms which "lead to different mixes of monetary and nonpecuniary incentives for administrators and staffs, different sources of capital, and different influences of governance." In addition to distinguishing among public and private sector web site users, therefore, it is important that future research compare commercial and not-for-profit users as well. This will be more difficult to accomplish, however. Public and private sector web sites have very different missions and function in very different ways.[42] Furthermore, unlike many European countries, in which state-owned enterprises and corporatist structures of governance remain common, there has long been a clear distinction in the United States between the public and private sectors that should enable people to distinguish between them at the electronic level. Because people can readily discern between the likes of Ford Motor Company and the U.S. Department of Transportation, Planned Parenthood and the Centers for Disease Control and Prevention, State Farm Insurance and the Federal Emergency Management Agency, and Merck Pharmaceuticals and the U.S. Food and Drug Administration, there is little reason to suspect that they would not know the difference between public and private sector web sites as well. However, although people may readily differentiate between government-sponsored web sites and private sector web sites, they may find it harder to distinguish commercial web sites from not-for-profit web locations. This latter difficulty should be kept in mind when developing future strategies to compare similarities and differences among Internet users visiting commercial and not-for-profit web sites.

In short, the present study breaks new ground by using a national survey of adults to determine the percentage and characteristics of Americans seeking health care information from public and private web sites. Whereas several previous studies identify the overall percentage of adults,[6,9–12] and/or Internet users searching for health information online,[6,7,9,11,12] none, as far as we could determine, identify the prevalence of those who visit publicly or privately sponsored web sites. Although several previous studies used multivariate techniques to model the characteristics associated with web site use,[9–12,33,34,44,45] none use survey data to systematically characterize similarities and differences in factors associated with use of public and private web sites, in particular. Despite our contributions, however, there are some limitations worth noting. First, results derive from self-reports rather than actual observation of behaviors. Not only do we have no way of determining the

accuracy of responses, but responses could be affected by recall bias or the tendency of survey respondents to provide socially desirable answers.[46] Second, although our response rate (25%) does not differ greatly from other national public opinion surveys and we achieved a relatively high cooperation rate (65%), it could be improved through use of more callbacks and longer survey period. Third, in order to promote responses, we restricted the length of the survey. Consequently, we kept the number of questions to a minimum, thereby reducing the pool of potential covariates available for analysis. Finally, although causality is much more easily attributed in longitudinal studies, we relied exclusively on cross-sectional data. Like in any cross-sectional survey, the associations reported in this article may not be indicative of causality.

CONCLUSION

Our study demonstrates differences in health care Internet use based on web site sponsorship. Because prior research focuses exclusively on overall use, this is the first effort to detect policy relevant differences related to use of governmental and nongovernmental web locations whether in terms of overall use or differences in user characteristics related to age, literacy, place of residence, or attitudes toward health care services. Like other studies, however, we find that the digital divide is more evident by age, education, income, and urban/rural location than by race or ethnicity. Furthermore, like other studies, we find that relatively few seek health care information over the World Wide Web, because few report accessing either publicly or privately sponsored web sites more than a handful of times per year, a low level of utilization that does not bode well for the future of the health care Internet. Indeed, use levels must rise far higher to gain the economies of scale necessary to allow technology to pay off for consumers and society as a whole. This will require a concerted effort on the part of both public and private actors to improve the quality, accessibility, and relevance of the health care information available. It will also require policymakers to account for differences in user characteristics, especially because factors contributing to the digital divide vary across the governmental and nongovernmental sectors.

REFERENCES

1. The White House. 2004, April 27. *Executive Order: Incentives for the Use of Health Information Technology*. Available at: www.whitehouse. gov. Accessed February 7, 2006.
2. Bodenheimer T, Grumbach K. Electronic technology: a spark to revitalize primary care? *JAMA*. 2003;290:259–264.
3. Kaushal R, Bates DW, Poon EG, et al. Functional gaps in attaining a national health information network. Harvard Interfaculty Program for Health Systems Improvement NHIN Working Group. *Health Aff (Millwood)*. 2005;24:1281–1289.
4. Rosenfeld S, Bernasek C, Mendelson D. Medicare's next voyage: encouraging physicians to adopt health information technology. *Health Aff (Millwood)*. 2005;24:1138–1146.
5. Hillestad R, Bigelow J, Bower A, et al. Can electronic medical record systems transform health care? Potential health benefits, savings, and costs. *Health Aff (Millwood)*. 2005;24:1103–1117.
6. Fox S. *Health Information Online: Eight in Ten Internet Users Have Looked for Health Information Online, with Increased Interest in Diet,*

250   © *2007 Lippincott Williams & Wilkins*

Fitness, Drugs, Health Insurance, Experimental Treatments, and Particular Doctors and Hospitals. Washington, DC: PEW Internet & American Life Project; May 2005.

7. Baker L, Wagner TH, Singer S, et al. Use of the Internet and E-mail for health care information. *JAMA.* 2003;289:2400–2406.

8. Blumenthal D. Doctors in a wired world: can professionalism survive connectivity? *Milbank Q.* 2002;80:525–546.

9. Brodie M, Flournoy RE, Altman DE, et al. Health information, the Internet, and the digital divide. *Health Aff (Millwood).* 2000;19:255–265.

10. Miller EA, West DM. *Where's the Revolution? Digital Technology and Health Care Communication in the Internet Age.* Prepared for Presentation at the American Political Science Association Conference, August 31–September 3, 2006. Providence, RI: Taubman Center for Public Policy, Brown University; 2006.

11. Rice RE. Influences, usage, and outcomes of internet health information searching: multivariate results from the PEW surveys. *J Am Med Inform Assoc.* 2006;75:8–28.

12. Ybarra ML, Suman M. Help Seeking behavior and the Internet: a national survey. *J Am Med Inform Assoc.* 2006;75:29–41.

13. Devereaux PJ, Heels-Andsell D, Lacchetti C, et al. Payments for care at private for-profit and private not-for-profit hospitals: a systematic review and meta-analysis. *Can Med Assoc J.* 2004;170:1817–1824.

14. Devereaux PJ, Choi PT, Lacchetti C, et al. A systematic review and meta-analysis of studies comparing mortality rates of private for-profit and private not-for-profit hospitals. *Can Med Assoc J.* 2002;166:1399–1406.

15. Hilmer MP, Woodchis WD, Gill SS, et al. Nursing home profit status and quality of care: is there any evidence of an association. *Med Care Res Rev.* 2005;62:139–166.

16. Morrow, et al. A population-based study of access to immunization among urban Virginia school children served by public, private, and military health care systems. *Pediatrics* 1998;101:E5.

17. Rosenau PV, Linder SH. A comparison of the performance of for-profit and nonprofit US psychiatric inpatient care providers since 1980. *Psychiatr Serv.* 2003;54:183–187.

18. Schlesinger M, Gray BH. How nonprofits matter in American medicine, and what to do about it. *Health Aff (Millwood).* 2006;Web-Exclusives(June 20, 2006):W287–W303.

19. Schlesinger M, Mitchell S, Gray BH. Public expectations of nonprofit and for-profit ownership in American medicine: clarifications and implications. *Health Aff (Millwood).* 2004;23:181–191.

20. Yedidia MJ. Differences in treatment of ischemic heart disease at a public and a voluntary hospital: sources and consequences. *Milbank Q.* 1994;72:299–327.

21. Andersen R. Revisiting the behavior model and access to care: does it matter? *J Health Soc Behav.* 1995;36:1–10.

22. Idler EL, Benyamini Y. Self-rated health and mortality: a review of twenty-seven community studies. *J Health Soc Behav.* 1997;38:21–37.

23. Goodman DC. Twenty-year trends in regional variations in the US physician workforce. *Health Aff (Millwood).* 2004;Web-Exclusives(October 7, 2004):VAR-90–VAR-97.

24. Selden CR, Zorn M, Ratzan S, et al. *Health Literacy: January 1990 Through October 1999, 479 Citations.* (Current Bibliographies in Medicine, CBM 2000-1.) Bethesda, MD: National Institute of Health, National Library of Medicine; February 2000.

25. Chew LD, Bradley KA, Boyko EJ. Brief questions to identify patients with inadequate health literacy. *Fam Med.* 2004;36:588–594.

26. Grant M, Marshall G, Hays R. *The Patient Satisfaction Questionnaire Short Form (PSQ-18).* Santa Monica, CA: Rand Corporation; 1994.

27. Battaglia MP, Hoaglin DC, Izrael D, et al. Improving income imputation by using partial income information and ecological variables. *Joint Statistics Meetings–Section on Survey Research Methods.* 2002:152–157.

28. Raghunathan TE. What do we do with missing data? Some options for analysis of incomplete data. *Annu Rev Public Health.* 2004;25:99–117.

29. Streiner DL. The case of the missing data: methods of dealing with dropouts and other research vagaries. *Can J Psychiatry.* 2002;47:70–77.

30. Davern M, Rodin H, Beebe TJ, et al. The effect of income question design in health surveys on family income, poverty, and eligibility estimates. *Health Serv Res.* 2005;40:1534–1552.

31. Schafer JL, Graham JW. Missing data: our view of the state of the art. *Psychol Methods.* 2002;7:147–177.

32. Chantala K, Suchindran C. *Multiple Imputation for Missing Data.* Chapel Hill, NC: University of North Carolina; 2005. Available at: www.cpc.unc.edu/services/computer/presentations/mi_presentation2.pdf. Accessed May 24, 2006.

33. Diaz JA, Griffith RA, Ng JJ, et al. Patients' use of the Internet for medical information. *J Gen Intern Med.* 2002;17:180–185.

34. Dickerson S, Reinhart AE, Feeley TH, et al. Patient Internet use for health information at three urban primary care clinics. *J Am Med Inform Assoc.* 2004;11:499–504.

35. Chang BL, Bakken S, Brown SS, et al. Bridging the digital divide: reaching vulnerable populations. *J Am Med Inform Assoc.* 2004;11:448–457.

36. Risk A, Petersen C. Health Information on the Internet. *JAMA.* 2002; 287:2713–2715.

37. Horrigan J, Murray K. *Rural Broadband Internet Use.* Washington, DC: Pew Internet & American Life Project; February 2006.

38. Eyesenbach G, Powell J, Kuss O, et al. Empirical studies assessing the quality of health information for consumers on the World Wide Web. *JAMA.* 2002;287:2691–2700.

39. Jadad A, Gagliardi A. Rating health information on the Internet: navigating to knowledge or to Babel? *JAMA.* 1998;279:611–614.

40. Purcell GP, Wilson P, Delamothe T. The quality of information on the Internet. *BMJ.* 2002;324:557–558.

41. West DM, Miller EA. The digital divide in public e-health: barriers to accessibility and privacy in state health department websites. *J Health Care Poor Underserved.* 2006;17.

42. West DM. *Digital Government: Technology and Public Sector Performance.* Princeton, NJ: Princeton University Press; 2005.

43. Fox S. *Wired Seniors: A Fervent Few, Inspired by Family Ties.* Washington, DC: PEW Internet & American Life Project; September 2001.

44. Abramson P, Aldrich J, Rohde D. *Change and Continuity in the 2004 Elections.* Washington, DC: Congressional Quarterly Press; 2006.

45. Hsu J, Huang J, Kinsman J, et al. Use of e-health services between 1999 and 2002: a growing digital divide. *J Am Med Inform Assoc.* 2005;12:164–171.

46. Presser S, Rothgeb JM, Couper MP, et al. *Methods for Testing and Evaluating Survey Questionnaires.* NJ: Wiley-Interscience; June 2004.

251