Understanding Health and Health-Related Behavior of Users of Internet Health Information

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Abstract

Background: *Little is known about how actual use of Internet health-related information is associated with health or health-related behavior.* ***Methods:*** *Using a nationally representative sample of 34,525 from 2012, this study examined the demographics of users of Internet health-related information (users), reports estimates of association with several health and behavioral outcomes adjusting for demographic factors, and analyzed the sample by education level, race, gender, and age.* ***Results:*** *Analysis of a large nationally representative sample shows evidence that users of health-related information (users) on the Internet are younger, more educated, more likely to be insured, more likely to be female, and less likely to be African American. After adjusting for demographic differences, users are more likely to have been diagnosed with hypertension, cancer, stroke, and high cholesterol, but no evidence of current hypertension, weight-related issues, or being in fair or poor health. Users are less likely to smoke and among smokers are more likely to attempt quitting. Users are more likely to exercise, get a flu shot, pap smear, mammogram, HIV test, colon cancer screening, blood pressure check, and cholesterol check, but likely to be heavy drinkers. With few exceptions, results appear robust across gender, age groups, level of education, and ethnicity.* ***Conclusions:*** *Use is generally positively associated with prior diagnosis for several conditions and behaviors related to improved health, but I find no relationship with existing health status. The association between use of health-related Internet information and health-related behavior seems robust across levels of education, age, gender, and race.*

Keywords: *behavioral health, Business Administration/ Economics, e-health, policy*

Introduction

Recent commentary has focused on the phenomena of patients using the Internet to look up medical information.[1,2] The primary focus of much of this discussion centers around whether or not patients' use of the Internet to look up medical information does good for patients. It could help patients become more aware of matters related to their health or it could spread falsehoods, which are detrimental to patient health. Additional concerns include how it could undermine the patient–physician relationship. The goal of this study is to look at the first of these questions. Is use of Internet for health information positively or negatively associated with health and health-related behavior?

Prior research on patient use of the Internet has primarily focused on three areas. First, several initial studies simply focused on who these users were. A second stream of research has focused on both patient perceptions of Internet health information compared with information supplied by providers. Finally, another stream of research focused on how use of these Web sites impacts the patient–physician relationship.

A 2005 study using data from the 2002–2003, Health Information National Trends Survey (HINTS) found users more likely to be younger, female, white, Asian, and more educated.[3] In addition, they found that users who were younger, more educated, and women were more likely to trust the Internet. Most of these users preferred physician to Internet as first source of information, but Internet was more likely to be actual first source. A more recent study using an expanded version of the same dataset found that public trust in physicians remains higher than Internet, trust in Internet declined over time.[4]

A 2007 qualitative study using eight disease-specific focus groups found that patients do not perceive the Internet information results in a desire to disrupt balance of power, but rather see the Internet as an additional resource to support existing resources.[5] A 2003 meta-analysis & review of 24 published cancer studies reported on a study, which found a strong relationship between Internet use and self-efficacy.[6,7]

The body of existing research on the effects of patient use of Internet information paints a generally positive picture from the patients' perspective, but questions remain as to the possible negative impacts. Research on who uses Internet information is relatively consistent. Evidence as to the impact of the Internet on health is thus far unclear.[8] The goal of this study is to use health information technology (HIT) responses recently added to the sample adult supplement in the

Nationwide Health Interview Survey (NHIS) to provide some empirical insight to these questions.

Methods

STUDY SAMPLE

First administered in 1957, the NHIS is a nationwide in person survey of the civilian noninstitutionalized population of about 35,000 households, or ~87,500 persons. The NHIS serves as a primary source of data on health. Historically, the NHIS has been used for monitoring health patterns and trends and tracking progress towards national goals. NHIS data is also widely used for policy analysis and research. NHIS contains two parts, a core set of demographic and basic health questions and one or more sets of supplemental questions on specific health topics, which vary over time based on topics of current concern. The U.S. Census Bureau administers the NHIS for the National Center for Health Statistics (NCHS) of the Centers for Disease Control and Prevention.

The 2012 version of the core Adult Healthcare Access and Utilization (AAU) section added a few questions related to use of information technology to access information on the Internet and communicate with healthcare providers. Specifically, the survey asked the question "DURING THE PAST 12 MONTHS, have you ever used computers for any of the following: … Look up health information on the Internet." Of the 34,525 responses, 13,621(39.45%) indicated "yes," 20,265 (58.70%) indicated "no," 32 refused to answer (0.09%), and 18 (0.05%) did not know and they were not able to ascertain 589 (1.71%) of the responses. It is important to note that the term "computers" could possibly confuse some as to whether a smart phone or tablet would be considered a "computer." For this reason in the analysis, the primary results are subjected to a subset analysis to ensure the results are robust across various subgroups such as age or level of education, which might perceive the term "computer" differently.

ANALYTIC APPROACH

This study used a three-phase statistical approach. First, the sample was split into users and nonusers, and summary statistics were calculated for available demographic factors. This was done for two reasons. Prior studies on usage utilized a more limited sampling frame. The goal was to see if this sample was consistent with prior findings and to use the larger nationally representative sample to provide more precise and up-to-date estimates of who the users are. Second, a series of regression analyses were performed using a set of limited controls and expanded controls. Logistic regression was used on binary outcomes, and ordinary least squares were used on continuous outcomes. The outcomes included 17 measures of health outcomes and 15 measures of health-related behavior. The limited controls were age dummies, gender, and race/ethnicity dummies. The expanded controls included the limited controls plus insured status, education level dummies, and regional dummies. Analysis was limited to those respondents to whom we were able to provide affirmative answers. The goal of these regressions was to provide an estimate of the association between use and various outcomes. Limitations of the data, such as the cross-sectional nature of the data and apparent lack of appropriate instrumental variables, were such that showing causation was not the goal. In the final analytical phase, a subset of outcomes was analyzed across levels of education, age groups, gender, and ethnicities. The goal of this analysis was to see if the results for these outcomes were robust across demographic factors known to be associated with use and health. Analysis was performed in STATA by the author and the author alone.

Results

DEMOGRAPHIC DIFFERENCES

Consistent with prior studies, the results show users are younger (difference, −7.09 years, 95% confidence interval [CI], −7.46 to −6.71), more educated (difference 2.43, 95% CI 2.37–2.50 on a 21-point scale), more likely to be female (odds ratio 1.50, 95% CI 1.44–1.57) and more likely to be Caucasian (odds ratio 1.39, 95% CI 1.32–1.46) or Asian (odds ratio 1.10, 95% CI 1.01–1.20). In addition, results show that users are more likely to be insured (odds ratio 1.50, 95% CI 1.42–1.59), less likely to be African American (odds ratio 0.58, 95% CI 0.54–0.62) or Hispanic (odds ratio 0.47, 95% CI 0.45–0.51), less likely to live in the South (odds ratio 0.77, 95% CI 0.74–0.81), and more likely to live in the Northeast (odds ratio 1.10, 95% CI 1.04–1.17), the Midwest (odds ratio 1.12, 95% CI 1.06–1.18), or the West (odds ratio 1.15, 95% CI 1.09–1.21). In summary, users appeared to be consistent with prior studies in that they were younger, more educated, more likely to be female, and more likely to be Caucasian or Asian. In addition, this study provides evidence that users are more likely to be insured and less likely to live in the South. A summary of the demographic differences is shown in *Table 1*.

ASSOCIATION WITH HEALTH STATUS AND HEALTH BEHAVIOR

The primary goal of this study is to examine the association between use of health information on the Internet and health and health-related behaviors. Using expanded controls, I examined measures of health; results showed that users are more likely to have ever been told by a doctor or health professional that they have hypertension (odds ratio 1.19, 95% CI 1.12–

Table 1. Demographic Differences Between Users and Non-users

	INTERNET		NO INTERNET		DIFFERENCE FOR INTERNET USERS[a]			
	MEAN	SD	MEAN	SD	EFFECT	LOWER CI	UPPER CI	*N*
Age	44.28	15.87	51.37	19.02	−7.09	−7.46	−6.71	33,886
Education	16.26	2.43	13.82	3.65	2.43	2.37	2.50	33,745
Female	61.69%	48.62%	51.73%	49.97%	1.50	1.44	1.57	33,886
Insured	85.59%	35.12%	79.81%	40.15%	1.50	1.42	1.59	33,782
Caucasians	78.84%	40.84%	72.84%	44.48%	1.39	1.32	1.46	33,886
African Americans	11.31%	31.67%	18.04%	38.45%	0.58	0.54	0.62	33,886
Asian	6.63%	24.88%	6.06%	23.87%	1.10	1.01	1.20	33,886
Hispanic	11.19%	31.52%	20.97%	40.71%	0.47	0.45	0.51	33,886
Northeast	17.54%	38.03%	16.17%	36.82%	1.10	1.04	1.17	33,886
Midwest	21.89%	41.35%	20.03%	40.02%	1.12	1.06	1.18	33,886
South	32.77%	46.94%	38.70%	48.71%	0.77	0.74	0.81	33,886
West	27.80%	44.80%	25.10%	43.36%	1.15	1.09	1.21	33,886

[a]For dichotomous variables, mean is the proportion of population and effect is reported as odds ratio.

CI, confidence interval; SD, standard deviation.

1.26), cancer (odds ratio 1.34, 95% CI 1.22–1.47), have had a stroke (odds ratio 0.78, 95% CI 0.66–0.92), an ulcer (odds ratio 1.33, 95% CI 1.21–1.47), hay fever (odds ratio 1.6, 95% CI 1.46–1.75), high cholesterol (odds ratio 1.36, 95% CI 1.28–1.44), asthma(odds ratio 1.29, 95% CI 1.2–1.39), and were more likely to have missed more work due to illness (difference 1.68, 95% CI 1.22–2.15) and spend more days in bed due to illness (difference 1.00, 95% CI 0.45–1.55). Using limited controls, the effect for hypertension and days in bed was not statistically significant, suggesting differences were explained by differences in education, health insurance, or regional differences. A prior diagnosis of hepatitis was not statistically significant for either set of controls. Chronic obstructive pulmonary disease (COPD) (odds ratio 0.60, 95% CI 0.49–0.72), hypertension within the last 12 months (odds ratio 0.82, 95% CI 0.72–0.93), body mass index (difference −0.8, 95% CI −1.1 to −0.49), obesity (odds ratio 0.86, 95% CI 0.83–0.90), and overweight status (odds ratio 0.88, 95% CI 0.82–0.92) were significant with limited controls, but not significant after controls for education level, insured status, and region were added. Results for health status seem to show that use is positively associated with several prior diagnoses, but results are mixed for measures of health status. Results for health status are shown in *Table 2*.

Next, I examined the association between use and health-related behavior. Results, for both limited and expanded controls, show that users are more likely to ever do vigorous exercise (odds ratio 1.44, 95% CI 1.37–1.51), to ever do moderate exercise (odds ratio 1.55, 95% CI 1.47–1.63), to get a flu shot in the past 12 months (odds ratio 1.34, 95% CI 1.27–1.41), mammogram in the past 12 months (odds ratio 1.32, 95% CI 1.21–1.44), pap smear (odds ratio 1.32, 95% CI 1.23–1.41), colon cancer screening in the past 12 months (odds ratio 1.3, 95% CI 1.2–1.41), HIV test (odds ratio 1.44, 95% CI 1.37–1.52), pneumonia shot (odds ratio 1.33, 95% CI 1.24–1.42), greater human papillomavirus (HPV) awareness (odds ratio 2.11, 95% CI 1.98–2.24), have blood pressure checked in the last 12 months (odds ratio 2.08, 95% CI 1.94–2.23), cholesterol checked in the last 12 months (odds ratio 1.48, 95% CI 1.4–1.56), and get a hepatitis B shot (odds ratio 1.41, 95% CI 1.33–1.49). Users are less likely to be current smokers (odds ratio 0.92, 95% CI 0.86–0.98) and among current smokers are more likely to have quit for at least 1 day because they were trying to quit smoking (odds ratio 1.53, 95% CI 1.36–1.71). In contrast to the aforementioned health-related behaviors, users are more likely to be heavy drinkers (odds ratio 1.15, 95% CI 1.03–1.28). Results for health-related behavior suggest that, with the exception of being more likely to be heavy drinkers, users are more likely to engage in a range of both get recommended preventative care and engage in behavior associated with improved health. Results of health-related behavior are shown in *Table 3*.

Table 2. Estimates of the Association Between Use and Health Status

	LIMITED CONTROLS[a]				EXPANDED CONTROLS[b]			
	EFFECT (STANDARD ERROR)	*p*	95% CI	*N*	EFFECT (STANDARD ERROR)	*p*	95% CI	*N*
Hypertension	1.02 (0.029)	0.595	0.96–1.07	33,855	1.19 (0.036)	<0.001	1.12–1.26	33,715
Cancer	1.48 (0.065)	<0.001	1.36–1.61	33,869	1.34 (0.063)	<0.001	1.22–1.47	33,686
Stroke	0.64 (0.051)	<0.001	0.55–0.75	32,821	0.78 (0.066)	0.003	0.66–0.92	32,683
Ulcer	1.12 (0.052)	0.011	1.03–1.23	33,861	1.33 (0.067)	<0.001	1.21–1.47	33,721
Hepatitis	1.08 (0.073)	0.249	0.95–1.23	33,708	1.1 (0.079)	0.203	0.95–1.26	33,574
Hay fever	1.76 (0.077)	<0.001	1.62–1.92	33,863	1.6 (0.075)	<0.001	1.46–1.75	33,723
Hi cholesterol	1.28 (0.037)	<0.001	1.21–1.36	33,798	1.36 (0.043)	<0.001	1.28–1.44	33,658
COPD	0.6 (0.059)	<0.001	0.49–0.72	29,430	0.86 (0.091)	0.167	0.7–1.06	29,299
Asthma	1.31 (0.045)	<0.001	1.22–1.4	33,867	1.29 (0.047)	<0.001	1.2–1.39	33,727
Diabetes	0.81 (0.034)	<0.001	0.75–0.88	33,865	1 (0.046)	0.987	0.91–1.09	33,726
Hi bp last 12 months	0.82 (0.053)	0.002	0.72–0.93	9,509	0.98 (0.068)	0.736	0.85–1.12	9,431
BMI	−0.8 (0.157)	<0.001	−1.1–0.49	33,886	−0.11 (0.166)	0.499	−0.44–0.21	33,745
Overweight	0.88 (0.022)	<0.001	0.83–0.92	33,886	1.01 (0.027)	0.644	0.96–1.07	33,745
Obese	0.86 (0.022)	<0.001	0.82–0.9	33,886	1.01 (0.028)	0.658	0.96–1.07	33,745
Lost work days	1.24 (0.223)	<0.001	0.81–1.68	21,826	1.68 (0.238)	<0.001	1.22–2.15	21,764
Days in bed	0.18 (0.264)	0.505	−0.34–0.69	33,865	1 (0.28)	<0.001	0.45–1.55	33,553
Fair or poor health	0.6 (0.021)	<0.001	0.56–0.64	33,872	0.96 (0.038)	0.332	0.89–1.04	33,732

[a]Limited controls include age, gender, and race indicators.

[b]Expanded controls include limited controls plus education indicators, insured status, and regional indicators.

BMI, body mass index; COPD, chronic obstructive pulmonary disease.

COMPARISON ACROSS DEMOGRAPHIC FACTORS

Finally, to see if the results were robust across groups, estimates were performed with expanded controls across age ranges, education levels, and gender for most behaviors. Smoking status, trying to quit smoking, moderate exercise, vigorous exercise, cholesterol check, blood pressure check, HIV test, HPV awareness, mammogram, pap smear, and colon cancer screenings were the behaviors to be subsampled. These were selected because they seemed to best cover the behavioral issues related to health. The demographic factor in question was not included in the controls when it was the demographic factor being analyzed.

By age, results show that users are less likely to smoke as they get older with the youngest age group of users actually being more likely to smoke, but among smokers, users are more likely to try to quit the younger they are. Across all age groups, users are consistently more likely to engage in moderate exercise and have their blood pressure checked. Interestingly, older users are less likely to report being in fair or poor health. Results from the main analysis held across various levels of education, with exception of smoking behavior. Among those who did not finish high school, users were more likely to smoke, but were also more likely to try to quit smoking. Gender did not have substantial effect on results, with the exception that male users who smoke are slightly more likely to try quitting. We also looked across ethnicities, but did not include results for the sake of brevity. Results were consistent across ethnicities, but magnitudes varied somewhat between ethnicities. In summary, with a few exceptions related to smoking behavior, results from the primary analysis held across demographic factors; however, estimates of magnitude of the effects did vary somewhat across groups. The subsample estimates are shown in *Tables 4–6*.

Discussion

The purpose of this study was to further the understanding of the relationship between the use of health-related information on the Internet and health and health-related behaviors. This is

Table 3. Estimates of the Association Between Use and Various Health-Related Behaviors

	LIMITED CONTROLS[a]				EXPANDED CONTROLS[b]			
	EFFECT (STANDARD ERROR)	*p*	95% CI	*N*	EFFECT (STANDARD ERROR)	*p*	95% CI	*N*
Vigorous exercise	2 (0.048)	<0.001	1.91–2.1	33,636	1.44 (0.038)	<0.001	1.37–1.51	33,500
Moderate exercise	2.03 (0.05)	<0.001	1.94–2.13	33,428	1.55 (0.041)	<0.001	1.47–1.63	33,293
Heavy drinker	1.17 (0.06)	0.002	1.06–1.29	33,459	1.15 (0.062)	0.012	1.03–1.28	33,284
Current smoker	0.66 (0.02)	<0.001	0.62–0.7	33,814	0.92 (0.03)	0.014	0.86–0.98	33,680
Tried to quit	1.55 (0.087)	<0.001	1.39–1.73	6,312	1.53 (0.09)	<0.001	1.36–1.71	6,293
Flu shot	1.57 (0.04)	<0.001	1.5–1.65	33,765	1.34 (0.037)	<0.001	1.27–1.41	33,629
Mammogram (age ≥40)	1.64 (0.068)	<0.001	1.52–1.78	11,964	1.32 (0.06)	<0.001	1.21–1.44	11,911
Pap smear	1.55 (0.05)	<0.001	1.46–1.65	18,717	1.32 (0.046)	<0.001	1.23–1.41	18,658
Colon screening (age ≥40)	1.42 (0.055)	<0.001	1.31–1.53	21,502	1.3 (0.055)	<0.001	1.2–1.41	21,393
HIV test	1.49 (0.038)	<0.001	1.42–1.57	33,185	1.44 (0.039)	<0.001	1.37–1.52	33,064
Pneumonia shot	1.37 (0.045)	<0.001	1.28–1.46	32,973	1.33 (0.047)	<0.001	1.24–1.42	32,844
HPV awareness	3.16 (0.091)	<0.001	2.99–3.34	26,473	2.11 (0.066)	<0.001	1.98–2.24	26,394
Bp checked	2.6 (0.086)	<0.001	2.44–2.77	33,722	2.08 (0.075)	<0.001	1.94–2.23	33,584
Cholesterol checked	1.71 (0.045)	<0.001	1.63–1.8	33,454	1.48 (0.043)	<0.001	1.4–1.56	33,321
Hepatitis B shot	1.82 (0.048)	<0.001	1.72–1.91	31,863	1.41 (0.04)	<0.001	1.33–1.49	31,743

[a]Limited controls include age, gender, and race indicators.

[b]Expanded controls include limited controls plus education, insured status, and regional indicators.

HPV, human papillomavirus.

Table 4. Estimates of Association of Behavior and Use by Education Level

	LESS THAN HS	HS OR GED	SOME COLLEGE	BACHELORS OR HIGHER
Current smoker	1.43 (1.18–1.74)	0.93 (0.83–1.04)	0.86 (0.78–0.95)	0.77 (0.66–0.9)
Tried to quit	1.96 (1.4–2.74)	1.6 (1.31–1.96)	1.45 (1.2–1.76)	1.36 (0.98–1.9)
Moderate exercise	1.8 (1.5–2.15)	1.49 (1.35–1.65)	1.56 (1.44–1.7)	1.58 (1.43–1.74)
Vig ever	1.63 (1.35–1.96)	1.45 (1.31–1.6)	1.44 (1.33–1.57)	1.41 (1.29–1.55)
Chol check	1.74 (1.41–2.14)	1.58 (1.41–1.77)	1.44 (1.31–1.58)	1.41 (1.27–1.56)
BP check	2.39 (1.87–3.04)	1.98 (1.73–2.28)	2.01 (1.78–2.26)	2.22 (1.94–2.54)
HIV test	1.62 (1.34–1.96)	1.39 (1.25–1.55)	1.47 (1.35–1.61)	1.41 (1.28–1.55)
HPV aware	2.63 (2.15–3.22)	2.33 (2.07–2.61)	1.99 (1.8–2.2)	2.06 (1.83–2.32)
Mammogram	1.33 (0.96–1.84)	1.5 (1.26–1.78)	1.33 (1.15–1.54)	1.23 (1.04–1.46)
Pap	1.03 (0.8–1.33)	1.45 (1.26–1.68)	1.29 (1.14–1.46)	1.27 (1.1–1.46)
Colon screen	0.98 (0.69–1.37)	1.48 (1.25–1.76)	1.37 (1.2–1.58)	1.24 (1.08–1.43)

Control factors include age indicators, insured status, gender, and indicators for race/ethnicity.

HS, high school education; GED, general education development degree.

Table 5. Estimates of Association of Behavior and Use by Age Group

	18–29	30–49	50–64	65 AND OVER
Current smoker	1.2 (1.05–1.38)	0.96 (0.87–1.07)	0.82 (0.72–0.92)	0.78 (0.62–0.98)
Tried to quit	1.69 (1.34–2.14)	1.58 (1.32–1.89)	1.45 (1.16–1.8)	1.11 (0.71–1.75)
Moderate exercise	1.56 (1.39–1.74)	1.6 (1.47–1.75)	1.52 (1.37–1.67)	1.52 (1.37–1.67)
Vig ever	1.39 (1.24–1.56)	1.43 (1.32–1.56)	1.47 (1.33–1.62)	1.47 (1.33–1.62)
Chol check	1.36 (1.21–1.52)	1.42 (1.31–1.55)	1.52 (1.36–1.71)	1.52 (1.36–1.71)
BP check	2.01 (1.77–2.28)	2.07 (1.86–2.3)	2.04 (1.74–2.4)	2.04 (1.74–2.4)
HIV test	1.48 (1.32–1.65)	1.52 (1.4–1.66)	1.41 (1.27–1.56)	1.58 (1.33–1.88)
HPV aware	2.12 (1.86–2.41)	2.26 (2.06–2.48)	1.95 (1.76–2.17)	N/A
Mammogram (40+)	N/A	1.24 (1.06–1.46)	1.28 (1.12–1.46)	1.28 (1.12–1.46)
Pap	1.47 (1.16–1.85)	1.38 (1.23–1.54)	1.23 (1.08–1.4)	1.23 (1.08–1.4)
Colon screen (40+)	N/A	1.62 (1.3–2.01)	1.25 (1.11–1.4)	1.25 (1.11–1.4)

Control factors include education indicators, insured status, gender, and indicators for race/ethnicity; NHIS did not inquire about HPV awareness for those 65 and older.
NHIS, Nationwide Health Interview Survey.

an important question because healthcare professionals have debated for sometime whether this use would help patients or harm patients. Research to date on this subject has primarily been limited to patient perceptions of such information and the impact on the doctor–patient relationship. Much of this debate would seem to be the result of the lack of evidence for physicians as to how use was associated with outcomes of concern; as a result, they would seem to be left to rely upon personal experience with a substantial societal shift. Using a large nationally representative sample, this study presents evidence of a positive association with several measures of health-related behavior. Evidence also shows that those with prior diagnosis for several common conditions are more likely to look up information on the Internet. This is consistent with studies of patient perceptions of such information as a complimentary source of information. I find no evidence of health status being better or worse for users. With a few exceptions regarding smoking behavior, results seem robust across major demographic factors.

Table 6. Estimates of Association of Behavior and Use by Gender

	MEN	WOMEN
Current smoker	0.87 (0.79–0.96)	0.94 (0.86–1.02)
Tried to quit	1.72 (1.45–2.05)	1.42 (1.21–1.66)
Moderate exercise	1.53 (1.41–1.66)	1.57 (1.47–1.68)
Vig ever	1.39 (1.28–1.5)	1.48 (1.39–1.59)
Chol check	1.6 (1.47–1.75)	1.37 (1.27–1.48)
BP check	2.07 (1.87–2.28)	2.07 (1.86–2.29)
HIV test	1.41 (1.3–1.53)	1.47 (1.37–1.58)
HPV aware	1.99 (1.83–2.17)	2.23 (2.04–2.43)
Colon screen	1.34 (1.19–1.51)	1.27 (1.13–1.42)

Control factors include age indicators, education indicators, insured status, and indicators for race/ethnicity.

This study has several limitations, which warrant discussion. First and foremost, this study does not show causation. In all likelihood, people who have received a disease diagnosis would seem to be more likely to seek information about their condition. The association between health behaviors and use of health information on the Internet could very well be the result of an unobserved cause such as general concern for one's health. The cross-sectional nature of this data makes these issues difficult to resolve with this data. In all likelihood, to address causation issues requires an experiment, but given the ubiquitous nature of the Internet today, experimental design in this area seems challenging. Second, this self-reported nature of the measures on both sides of the equations could be subject to the same self-report bias. Finally, this study did not explore the magnitude of use.

This study has several implications for both research and practice. For research, several questions remain. The aforementioned causal questions could be addressed with larger

panel datasets over time or experimentation. This study did not explore the magnitude of use, exploring something beyond a dichotomous variable would seem useful. In addition, further examination of which populations have which associations with use would seem to be an important question. Additional outcome variables could be explored as well. Finally, interactions between use and various demographic factors could be explored.

Implications for practice are twofold. This study provides evidence that users of health information on the Internet are more likely to exhibit a number of behaviors known to improve health. This study also shows that these associations are robust across a number of common demographic factors.

In conclusion, patient use of health-related information on the Internet has been the subject of debate among healthcare providers for a while. Using a large nationally representative sample, this study presented evidence, which suggests that the use of health-related information on the Internet is generally positively associated with a number of health-related behaviors. Evidence as to the association between use and health is mixed. Use is positively associated with prior diagnosis for several conditions, but no consistent relationship with existing health status is evident in this data. The association between use of health-related Internet information and health-related behavior seems robust across levels of education, age, gender, and race. Users are more likely to be females, younger, more educated, insured, and more likely to be Caucasian or Asian.

Disclosure Statement

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REFERENCES

1. Hartzband P, Groopman J. Untangling the Web—Patients, doctors, and the Internet. *N Engl J Med* **2010**;362:1063–1066.
2. Truog RD. Patients and doctors—The evolution of a relationship. *N Engl J Med* **2012;**366:581–585.
3. Hesse BW, et al. Trust and sources of health information: The impact of the Internet and its implications for health care providers: Findings from the first Health Information National Trends Survey. *Arch Intern Med* **2005;**165:2618–2624.
4. Hesse BW, Moser RP, Rutten LJ. Surveys of physicians and electronic health information. *N Engl J Med* **2010;**362:859–860.
5. Stevenson FA, et al. Information from the Internet and the doctor-patient relationship: The patient perspective—A qualitative study. *BMC Fam Pract* **2007;**8:47.
6. Murray E, et al. The impact of health information on the Internet on the physician-patient relationship: Patient perceptions. *Arch Intern Med* **2003;**163:1727–1734.
7. Diaz JA, et al. Patients' use of the Internet for medical information. *J Gen Intern Med* **2002;**17:180–185.
8. Eysenbach G. The impact of the Internet on cancer outcomes. *CA Cancer J Clin* **2003;**53:356–371.

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