Use of the Internet and E-mail for Health Care Information

Results From a National Survey

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Context The Internet has attracted considerable attention as a means to improve health and health care delivery, but it is not clear how prevalent Internet use for health care really is or what impact it has on health care utilization. Available estimates of use and impact vary widely. Without accurate estimates of use and effects, it is difficult to focus policy discussions or design appropriate policy activities.

Objectives To measure the extent of Internet use for health care among a representative sample of the US population, to examine the prevalence of e-mail use for health care, and to examine the effects that Internet and e-mail use has on users' knowledge about health care matters and their use of the health care system.

Design, Setting, and Participants Survey conducted in December 2001 and January 2002 among a sample drawn from a research panel of more than 60 000 US households developed and maintained by Knowledge Networks. Responses were analyzed from 4764 individuals aged 21 years or older who were self-reported Internet users.

Main Outcome Measures Self-reported rates in the past year of Internet and e-mail use to obtain information related to health, contact health care professionals, and obtain prescriptions; perceived effects of Internet and e-mail use on health care use.

Results Approximately 40% of respondents with Internet access reported using the Internet to look for advice or information about health or health care in 2001. Six percent reported using e-mail to contact a physician or other health care professional. About one third of those using the Internet for health reported that using the Internet affected a decision about health or their health care, but very few reported impacts on measurable health care utilization; 94% said that Internet use had no effect on the number of physician visits they had and 93% said it had no effect on the number of telephone contacts. Five percent or less reported use of the Internet to obtain prescriptions or purchase pharmaceutical products.

Conclusions Although many people use the Internet for health information, use is not as common as is sometimes reported. Effects on actual health care utilization are also less substantial than some have claimed. Discussions of the role of the Internet in health care and the development of policies that might influence this role should not presume that use of the Internet for health information is universal or that the Internet strongly influences health care utilization.

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THE INTERNET HAS BEEN RECOGnized for many years as an important, if concerning, mechanism for transforming medical care.[1-6] While questions remain about its limitations,[7] concerns regarding misinformation,[3,8-13] and potential difficulties with the confidentiality of personal information,[14,15] the Internet appears to have promise as a means to disseminate information about health and health care, enhance communication, and facilitate a wide range of interactions between patients and the health care delivery system. These kinds of changes could produce important improvements in health care and, ultimately, the health of the population. Understanding the extent to which the Internet is being used for health purposes and the effects it has on health care use would help identify the extent to which these benefits are being realized and provide a context for fruitful discussions of the current and future role of the Internet in health care.

Commonly cited estimates suggest that more than half[15-17] and as much as 80%[18-20] of adults with Internet access use it for health care purposes. Many of those who use the Internet for health purposes are reported to use it frequently. These estimates have been widely disseminated and now frequently form the context for discussions among the media and others of the role of the Internet in health care.[21-28] However, other, perhaps less well-publicized reports suggest much lower rates of use.[14,29,30] Comparing existing estimates can be difficult because details on aspects such as selection or nonresponse bias are frequently

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not presented in the reports, many of which appear online or as private releases rather than in peer-reviewed journals.

The wide variation in estimates of the extent of Internet use for health, coupled with the fact that the highest estimates have been the most widely disseminated, makes it difficult to focus discussions about the role of the Internet in health care and develop appropriate responses. Clearer information is needed as a foundation for future steps. This article reports results from a survey that measures the extent of Internet use for health care among a large, well-defined, representative sample of the US population.

We also examined the prevalence of e-mail use for health care. Previous literature expresses both optimism and concern about the use of e-mail for patient-physician communication.[31-33] Reports based on surveys of limited sets of patients cite widespread access to e-mail and generally favorable attitudes toward it,[34,35] but few studies identify the prevalence of e-mail use in practice.[36] Finally, we examined the effects that Internet and e-mail use has on users' knowledge about health care topics and their use of the health care system.

METHODS

During December 2001 and January 2002, we surveyed a nationally representative sample of the US population aged 21 years or older about their use of the Internet and e-mail for health. We drew our sample from a research panel of more than 60 000 households developed and maintained by Knowledge Networks (Menlo Park, Calif), a survey research firm. To construct the panel, Knowledge Networks used random-digit dialing to contact potential panel households, inviting them to join the research panel. To facilitate surveying the panel and to create an incentive for participation, they provide all households in which an individual agrees to participate in the panel with free Internet access via WebTV (Microsoft Inc, Redmond, Wash). Surveys of individuals from the panel are conducted using the Internet. The ability of this research panel to support nationally representative analyses has been studied in a number of ways, all of which substantiate its validity. We conducted specific tests of the validity of the survey sample used for this study, which showed that it tracks key indicators from other major national surveys. (These analyses are reported in an appendix to this article that is available from the authors.) Our survey was sent to 12 878 individuals consisting of a random sample of adults aged 21 years or older and random oversamples of individuals aged 50 or older and veterans. Responses were obtained from 8935 (69.4%) of those surveyed. We use post-stratification weights, which correct the distribution of respondents to match the known distribution of the US population on age, sex, race, education, region, metropolitan residence, and veteran status, to account for the oversamples and for nonresponse.

Previous studies have typically reported rates of Internet use for health care among respondents with Internet access. All of the members of our sample have Internet access because all have the WebTV provided by Knowledge Networks. Because our sample contains individuals who did not obtain Internet access on their own, as a whole it is probably not directly comparable with samples with Internet access analyzed in other studies. To provide comparable information, we analyzed the subgroup of our sample who reported that they had used the Internet before they were given WebTV. We expect this group of "Internet users" to be comparable with those identified in other studies as Internet users. Of the 8935 survey respondents, 4764 reported using the Internet before getting WebTV.

The survey contained an extensive set of questions about use of the Internet and e-mail for health care information and the perceived effects of Internet or e-mail use on health care use. In some sections, respondents who self-reported having any of 5 chronic conditions were asked questions specific to their condition. The 5 conditions were heart problems (defined as a "heart attack," coronary heart disease, angina, heart failure, or other heart problems), cancer, diabetes, hypertension, and depression. Respondents who indicated having more than 1 condition were randomly assigned 1 of the conditions that they indicated for the condition-specific questions. Comparisons of Internet and e-mail use among patients with different conditions are presented elsewhere.[37]

We analyzed responses using standard tabulations. We used logistic regression analyses to investigate the relationships between Internet and e-mail use for health care and age, sex, annual household income, education, self-reported health status, and residence in a Metropolitan Statistical Area. These models exclude cases with missing data for household income and self-reported health status. Standard errors in the regressions are adjusted for the complex survey design. Analyses were performed using Stata (Stata Corp, College Station, Tex). $P<.05$ was considered statistically significant.

RESULTS

Prevalence of Internet and E-mail Use for Health Information

Our analysis sample included 4764 individuals who responded to the survey and who reported that they had used the Internet before receiving the WebTV service. TABLE 1 describes the demographic characteristics of the sample.

The survey asked 4 main questions about use of the Internet and e-mail for health care purposes in the last year (TABLE 2). Approximately 40% of Internet users in our sample reported that they used the Internet for information or advice about health or health care during the past year. Next most common was use of e-mail or the Internet to communicate with family or friends about health in the past year. Use of e-mail or the Internet to communicate with a health care professional or with other people who have similar health conditions or concerns was less common.

Among those who use the Internet for health care, use was relatively infrequent. Thirty-one percent of respondents (who comprised 78% of those who reported ever using the Internet for

health) said they used the Internet for health every 2 to 3 months or less. Only 9% of respondents (22% of those who said they used the Internet for health) said they used the Internet once a month or more. Similar frequencies were observed for use of e-mail.

Table 1. Sample Characteristics of Internet Users (N = 4764)*

	Weighted %
Age, y	
21-34	32.7
35-49	38.1
50-64	21.3
65-74	5.8
≥75	2.1
Mean (SD)	42.5 (13.7)
Male sex	47.2
Household income, $	
<25 000	21.2
25 000-49 999	34.5
50 000-74 999	23.5
≥75 000	20.7
Education, y	
≤12	41.4
13-16	49.1
>16	9.6
Health status	
Excellent/very good	54.8
Good	34.3
Fair/poor	11.0
Residency	
Urban	79.9
Nonurban	20.1
Chronic conditions†	
≥1	43.7
0	56.3

*Because of item nonresponse, unweighted n = 4280 for income distribution, 4760 for health status distribution, and 4756 for chronic condition distribution.
†The 5 chronic conditions inquired about are heart problems, cancer, diabetes, hypertension, and depression.

We examined the relationship between the use of e-mail and use of the Internet for health. Fifty percent of respondents said that they had used the Internet or e-mail in at least 1 of the 4 measured ways. Of these, 42% reported using the Internet for health information without use of e-mail. Rates of e-mail use were notably higher among those who reported Internet use for health. Forty-seven percent of those who reported Internet use also reported using e-mail for 1 or more of the 3 measured purposes as opposed to 16% of those who did not report using the Internet. Specific examination of the association between health Internet use and e-mail communication with physicians showed that 10% of those who reported Internet use also reported e-mail communication with a physician as opposed to 3% of those who did not report Internet use.

Demographics and Internet Use for Health

TABLE 3 reports results from logistic regression analyses that examined the relationships between respondent demographics and Internet and e-mail use for health. Individuals aged 75 years or older were much less likely to report use of the Internet for health than younger individuals. The odds of use for men were about half of the odds for women ($P<.001$). We observed strong relationships between higher education levels and higher rates of Internet use for health but no strong relationship with income. Respondents who self-reported worse health status were more likely to report using the Internet for health and health care.

There were no significant demographic relationships for the rate of making e-mail contact with a physician or other health care professional, for which the rate of any use was low in general. Relationships between demographics and rates of e-mail contact with family or friends were similar to those found for Internet use for health. When we examined use of e-mail or the Internet to contact others with similar health concerns, we found no trend toward less use with age and a weak relationship with education. Higher-income households were less likely to use e-mail or the Internet to contact others with similar health concerns, and individuals reporting worse health status were more likely to do so.

Effects of Internet Use on Health Care

We asked respondents who reported that they had ever used the Internet or e-mail for health purposes a series of questions about the effects of Internet or e-mail use on their knowledge about health care issues and their use of health care. Those who indicated having heart problems, cancer, diabetes, hypertension, or depression were asked questions about the effects of the Internet or e-mail specific to their condition. Those who did not indicate having 1 of these conditions were asked more general questions. These questions were phrased so that respondents could indicate that they strongly agreed, agreed, disagreed, or strongly disagreed that the Internet or e-mail had various effects. TABLE 4 reports the percentages of respondents who strongly agreed or agreed that use of the Internet or e-mail had the indicated effect. Among those without any of the 5 chronic conditions, 67% said that use of the Internet improved their understanding of health care issues, but fewer

Table 2. Prevalence and Frequency of Internet and E-mail Use for Health Information*

	Frequency of Use, Weighted %					
In the Past Year, About How Often Did You	Ever in Last Year	More Than Once/wk	About Once/wk	Once/mo	Every 2-3 mo	Less Than Every 2-3 mo
Look on the Internet for information or advice about health or health care? (n = 4760)	39.7	1.6	2.2	4.8	6.1	25.0
Use e-mail or the Internet to communicate with a doctor or other health care provider? (n = 4737)	6.0	0.8	0.4	0.6	0.9	3.3
Use e-mail or the Internet to communicate with a family member or friend about health or health care? (n = 4734)	25.5	1.5	2.0	3.3	3.9	14.8
Use e-mail or the Internet to communicate with other people who have health conditions or concerns like yours? (n = 4722)	11.2	0.8	1.1	1.6	1.5	6.3

*Data are shown as weighted percentages of responses in each category. Sample sizes differ across questions because of item nonresponse.

respondents said that the Internet affected more substantive decisions or activities such as improving their ability to manage their health care needs on their own or influencing their choice of health care professional. We obtained similar results among those with 1 or more of the chronic conditions. About half of these respondents indicated that use of the Internet improved their understanding of their chronic condition, treatments for their chronic condition, or other symptoms, conditions, or treatments, while the percentage indicating effects on decisions about health or health care or on use of the health care system ranged from 7% to 32%.

Two questions specifically asked about effects of Internet use on contacts with the health care system (TABLE 5). Respondents were asked about the effect of Internet or e-mail use in the last year on the number of times they had visited or telephoned a physician or other health care professional. In both cases, more than 90% of respondents indicated that use of the Internet or e-mail had no effect on the number of contacts.

Use of the Internet for Prescription Drugs

We asked respondents who self-reported that they had taken a prescription medication in the past year several questions about their use of the Internet for prescription drugs (TABLE 6). Five percent or less said that they used the Internet to obtain prescriptions either from their physician or from an online physician whom they had not seen in person, purchase prescription drugs, or search for the cheapest place to buy a prescription drug. Thirty-three percent indicated that they had used the Internet or e-mail to learn more about a prescription drug.

COMMENT

Extent and Frequency of Internet Use for Health

We estimate that approximately 40% of the adult US population with Internet access used the Internet for information or advice about health or health care in 2001. About half of the adult US population uses the Internet at all,[29] suggesting that about 20% of the entire adult population in the United States used the Internet for health care purposes in 2001. These numbers are substantially lower than the rates of Internet use for health care that are often reported. Highly publicized reports have suggested that a majority and, in some reports, even as many as 80% of US adults with Internet access use the Internet for health care purposes.[15,16,18-20] However, our results are consistent with other, perhaps less widely publicized reports of 35% to 37% in recent years.[14,29]

We also found that Internet use for health is relatively infrequent. Seventy-eight percent of those who ever used the Internet for health care in 2001 reported using it every 2 to 3 months or less. Only 22% of those who ever used the Internet reported using it once a month or more. Again, our estimates are much lower than those reported in other studies. One recent report indicated that 59% of adults who search for health information online do so about once a week to once a month.[15] In another report, the mean number of times per month users said they looked for

Table 3. Use of Internet for Health Information by Demographic Characteristics*

	Search for Health Information on the Internet		E-mail Physician		E-mail Family/Friends		E-mail Others	
Characteristics	Odds Ratio (95% Confidence Interval)	*P* Value	Odds Ratio (95% Confidence Interval)	*P* Value	Odds Ratio (95% Confidence Interval)	*P* Value	Odds Ratio (95% Confidence Interval)	*P* Value
No. of observations	4274		4259		4256		4247	
Age, y								
35-49	1.1 (0.8-1.4)	.60	0.8 (0.5-1.4)	.52	0.9 (0.6-1.2)	.33	1.0 (0.6-1.5)	.87
50-64	1.1 (0.8-1.4)	.65	0.7 (0.5-1.2)	.19	0.9 (0.7-1.2)	.57	0.9 (0.6-1.4)	.78
65-74	1.2 (0.8-1.6)	.41	0.5 (0.3-1.0)	.07	0.8 (0.6-1.2)	.38	0.8 (0.5-1.4)	.47
≥75	0.6 (0.4-1.0)	.048	0.7 (0.3-1.6)	.44	0.9 (0.5-1.6)	.74	1.3 (0.6-2.7)	.44
Male sex	0.5 (0.4-0.6)	<.001	1.1 (0.7-1.7)	.55	0.6 (0.5-0.8)	<.001	0.7 (0.5-1.0)	.08
Household income, $								
25 000-49 999	1.0 (0.7-1.4)	.96	0.7 (0.4-1.2)	.17	0.8 (0.6-1.1)	.15	0.7 (0.5-1.2)	.18
50 000-74 999	0.9 (0.7-1.2)	.56	0.5 (0.3-1.0)	.06	0.8 (0.5-1.1)	.12	0.4 (0.2-0.6)	<.001
≥75 000	1.1 (0.8-1.5)	.53	0.7 (0.4-1.3)	.27	0.9 (0.6-1.3)	.55	0.5 (0.3-0.8)	.004
Education, y								
13-16	2.0 (1.6-2.5)	<.001	1.2 (0.8-2.0)	.39	1.4 (1.1-1.8)	.005	0.9 (0.6-1.3)	.50
≥17	2.8 (2.0-3.9)	<.001	1.4 (0.8-2.5)	.21	2.5 (1.7-3.5)	<.001	1.1 (0.7-1.7)	.70
Resident of MSA	1.2 (0.9-1.6)	.15	1.0 (0.5-1.7)	.86	0.9 (0.6-1.2)	.38	0.9 (0.6-1.4)	.62
Health status								
Good	1.1 (0.9-1.4)	.39	1.4 (0.9-2.2)	.18	1.5 (1.1-1.8)	.003	1.3 (0.9-1.9)	.12
Fair/poor	1.8 (1.3-2.5)	<.001	1.4 (0.8-2.6)	.29	2.3 (1.6-3.2)	<.001	2.1 (1.3-3.4)	.004

Abbreviation: MSA, Metropolitan Statistical Area.
*Models contain an intercept. Referent categories are as follows: age 21 to 34 years; female sex; household income under $25 000; 12 or fewer years of education; nonresidence in an MSA; and excellent/very good health status.

health information online was 3, and the median was 1.2.[18] Our results cannot be directly compared with these results, but our results imply a median number of uses per month much lower than 1.2.

One plausible explanation for the differences in reported use rates is differences in the samples. Some previous work, including the surveys that report the highest rates of Internet use for health care,[19,20] is based on samples developed by using online recruitment. Other previous work used telephone surveys. One possibility is that the samples used in these studies overrepresent individuals who are particularly enthusiastic about the Internet and who might be both more likely to use it for health information and more willing to participate in surveys about it. Although we cannot unequivocally rule out the existence of selection bias in our own sample, our analyses of the sample are consistent with the view that it is representative of the population of the United States and, thus, we do not expect that selection bias is likely to have significantly influenced our results.

Although sample differences are a plausible explanation, we cannot provide specific evidence about their relative importance. Other possible explanations include differences in the wording of questions and the presentation of the survey. We believe that our question about Internet use for health provides a wide scope for an affirmative answer and is thus likely to capture a broad range of use and unlikely to lead us to underestimate use, but our question did ask about Internet use in the past year, and some other surveys are less precise about the time frame to which questions pertain. For example, a recent Harris Poll asked, "How often do you look for information online about health topics—often, sometimes, hardly ever or never?"[18] Differences in the specification of the time frame could play a role in the variations in the findings, although the comparable questions on other prominent surveys generally appear to refer to current use patterns, which may not imply a time frame substantially different than the past year.

It is tempting to interpret a finding that 40% of adults with Internet access use the Internet for health care information—much lower than common previous reports—as disappointing news for the Internet. It is not clear to us that this is the case. Although the Internet existed a decade ago, very few people would have used it then for health care purposes. That the number of people using the Internet for health has grown to include 40% of online adults could easily be viewed as a success. A useful point of comparison is reported rates of Internet use for other activities. Results from the US Census Bureau's Current Population Survey, a highly regarded regular survey of the US population, suggest that about 62% of online adults use the Internet to check news, weather, or sports information; 42% play games online; and

Table 4. Perceived Effects of Internet or E-mail Use on Health Care Understanding and Decisions*

Effect of Using the Internet or E-mail	No. of Respondents	Agree or Strongly Agree, Weighted %
Among Respondents With None of 5 Chronic Conditions		
Improved my understanding of symptoms, conditions, or treatments in which I was interested	1119	67
Improved my ability to manage my health care needs without visiting a doctor or other health care provider	1112	30
Led me to seek care from different doctors or other health care providers than I otherwise would have	1104	12
Affected the way I eat or exercise	1115	27
Among Respondents With ≥1 of 5 Chronic Conditions		
Improved my understanding of [condition]	1382	48
Improved my understanding of possible treatments for [condition]	1378	46
Improved my understanding of other symptoms, conditions, or treatments in which I was interested	1396	58
Affected treatments I am using for [condition]	1364	16
Improved my ability to manage my [condition] by myself	1359	27
Improved my ability to manage other health care needs without visiting a doctor or other health care provider	1375	30
Led me to seek care from different doctors or health care providers for [condition] than I otherwise would have	1360	7
Affected the way I eat or exercise	1370	32

*Questions were asked of those who said that they had used the Internet to look for information or advice about health or health care; used e-mail or the Internet to communicate with a provider, friend, family member, or other person with similar health care concerns; or used the Internet for any purpose related to prescription drugs. The full question preamble was, "Thinking overall about all of the times in the last year that you used the Internet or e-mail for things related to health or health care, to what extent would you agree or disagree with the following statements? Using the Internet or e-mail . . ." Response choices on a 4-point Likert scale were strongly agree, agree, disagree, strongly disagree. Condition was specified as heart problems, diabetes, cancer, hypertension, or depression based on the chronic condition(s) the respondent indicated. Sample sizes are unweighted; percentages are weighted.

Table 5. Perceived Effect of Internet Use on Physician Visits and Telephone Calls*

Did Using the Internet or E-mail Affect Either of the Following?	Weighted %		
	Increased	No Effect	Decreased
No. of times visited a physician or other health care provider	3	94	3
No. of times telephoned a physician or other health care provider	2	93	5

*Data are shown as weighted percentages of responses in each category. Questions were asked of those who said that they had ever used the Internet to look for information or advice about health or health care; used e-mail or the Internet to communicate with a provider, friend, family member, or other person with similar health care concerns; or used the Internet for any purpose related to prescription drugs. Unweighted sample sizes are 2548 and 2553, respectively, for the 2 questions. The full question preamble was, "Thinking overall about all of the times in the last year that you used the Internet or e-mail for things related to health or health care, did using the Internet or e-mail affect either of the following?"

39% shop online.[29] At the lower end, 18% report using the Internet for banking or paying bills, 17% report accessing chat rooms or listservs, and 9% report trading stocks online. In this context, a utilization rate of 40% seems relatively high.

One intuitive interpretation of a utilization rate of about 40% is that the Internet holds the most promise for a subset of the population. There are a number of sources of health information available to interested individuals, of which the Internet is one. Optimal results for health care delivery are most likely to be achieved if individuals seek information from the source that is most effective for them, and that source may not be the Internet for everyone, not even for everyone with Internet access. It may not be reasonable to expect that everyone with Internet access will use the Internet for health care or that encouraging everyone with Internet access to use it for health care information would be the best course of action. This, though, would not mean that the Internet is not highly valuable for the subset of the population that uses it.

Some particular challenges are highlighted by our analysis of the relationships between demographics and Internet use for health care. In particular, we find that individuals with less education are less likely to use the Internet for health care. These findings parallel more general findings about the prevalence of Internet use for any reason[29] and raise important questions about the ability of the Internet as currently structured to provide benefits to populations that need health information and potentially have a difficult time getting it.

Overall, these findings suggest that discussions about using the Internet for health care should be calibrated to account for a lower prevalence and lower frequency of use than often reported. Actions taken based on the presumption that frequent Internet use for health is the rule rather than the exception could be misdirected.

E-mail Use for Health Care

E-mail use in general is widespread, with nearly all online adults reporting its use.[16,29] Our results, though, show little use of e-mail in patient-physician communications. We estimate that 6% of US adults with Internet access used e-mail to communicate with a health care professional in 2001, consistent with other reports suggesting limited use in practice.[16,36]

Other forms of communication facilitated by e-mail should not be overlooked in discussions of the role of online activities in health. About one quarter of Internet users said that they used e-mail to communicate with family or friends about health issues, which could facilitate better access to or information about health care. Although the number was smaller, some also said that they used e-mail or the Internet to communicate with other patients. Studies show that information sharing can help patients in at least some situations.[38-40]

Table 6. Internet Use for Prescription Drugs*

Ever Use of E-mail or the Internet in Past Year to	Yes, Weighted %
Get a prescription from participant's own physician	2
Get a prescription from a physician that respondent has never seen in person	<1
Purchase prescription drugs	5
Learn more about a drug	33
Search for the cheapest place to buy prescription drugs	4

*Questions were asked of those who said that they had taken any prescription medication in the past year. Unweighted sample sizes are 3668, 3667, 3668, 3670, and 3649, respectively. The full question preamble was, "In the past year, did you ever use e-mail or the Internet to . . . ?" Response options were "yes" or "no." Percentages are weighted.

Effects of Using the Internet on Health Knowledge and Health Care Use

The Internet and e-mail could influence health care through a variety of channels. One key way is by enhancing the provision of information. This may provide intangible benefits like making patients more comfortable or confident about their care. It may also produce more tangible effects on their use of health care. Information gleaned from the Internet may improve patients' ability to interact efficiently and productively with health care professionals. In some cases, it may make them better able to care for themselves and reduce the need to consume expensive health care resources with problems that can be managed without additional help. Of course, it is also possible for the Internet to provide information that would reduce the well-being of patients. Previous work has frequently pointed out wide variations in the quality of information available on the Internet.[3,8-13] Erroneous or poorly targeted information may lead to poor treatment choices. An overabundance of extraneous, irrelevant, or invalid information may place new burdens on health care professionals and detract from their ability to provide care efficiently.

Consistent with some other work,[15,41] our results suggest that Internet users can find information they consider useful on the Internet. The majority of respondents indicated that using the Internet or e-mail improved at least some aspect of their knowledge about health care issues. This appears to be an encouraging sign of the ability of the Internet and e-mail to benefit patients, although some further information would be valuable. First, since there are not clear benchmarks for the number of users who should be able to benefit from use, it is not clear whether the results we observe are objectively high or low. On one hand, perhaps it is reasonable to expect that the Internet should be able to provide at least some valuable information to almost everyone who seeks information online. On the other hand, perhaps many users already have a good understanding of their issue of interest when they use the Internet. Second, although it is tempting to infer that the well-being of users who find information they consider useful online will have been improved, this is not necessarily true. Our study did not have the ability to identify the objective quality of the information found by users, nor did this study determine whether In-

ternet use provided information to users that they would not otherwise have obtained as opposed to simply substituting for other information sources.

In contrast with some other reports,[15] our results suggest that the Internet is much less frequently an influence on health care utilization, such as by affecting treatments used or making respondents more able to manage conditions on their own. More than 90% of respondents said that using the Internet had no effect on either physician visits or telephone contacts.

As a whole, these results suggest that the Internet does function as a means for informing consumers about health and health care, although there may still be room for improvement. Effects on actual decisions are less common, and effects on actual health care utilization are very limited. Discussions of the role of the Internet should not presume that it is now regularly having strong impacts on actual health care utilization.

Prescription Drugs

The role of the Internet in prescription drug markets is increasingly discussed. The Internet may be a useful way to facilitate the purchase of prescription drugs, improving convenience for patients and saving money. It may also undermine traditional pharmacy practices designed to maintain safety, with patients seeking prescriptions from online physicians with limited information on their clinical characteristics. Our results show that the practical reality of either of these positions is currently very small. Although some respondents report that the Internet is a source of information about prescription drugs, almost no one indicated obtaining prescriptions or purchasing prescription drugs online.

CONCLUSION

We found evidence of moderate rates of use of the Internet for health care among adult Internet users, moderate effects of the Internet on the knowledge of users, and very small effects on actual use of office visits, telephone calls to health care professionals, and pharmaceutical purchases. Nonetheless, the Internet clearly is an important tool with the potential to improve information dissemination and perhaps to improve health care delivery and outcomes. Continuing efforts to maximize the potential of this tool could have great value.

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Use of the Internet and E-mail for Health Care Information

Results From a National Survey

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Context The Internet has attracted considerable attention as a means to improve health and health care delivery, but it is not clear how prevalent Internet use for health care really is or what impact it has on health care utilization. Available estimates of use and impact vary widely. Without accurate estimates of use and effects, it is difficult to focus policy discussions or design appropriate policy activities.

Objectives To measure the extent of Internet use for health care among a representative sample of the US population, to examine the prevalence of e-mail use for health care, and to examine the effects that Internet and e-mail use has on users' knowledge about health care matters and their use of the health care system.

Design, Setting, and Participants Survey conducted in December 2001 and January 2002 among a sample drawn from a research panel of more than 60 000 US households developed and maintained by Knowledge Networks. Responses were analyzed from 4764 individuals aged 21 years or older who were self-reported Internet users.

Main Outcome Measures Self-reported rates in the past year of Internet and e-mail use to obtain information related to health, contact health care professionals, and obtain prescriptions; perceived effects of Internet and e-mail use on health care use.

Results Approximately 40% of respondents with Internet access reported using the Internet to look for advice or information about health or health care in 2001. Six percent reported using e-mail to contact a physician or other health care professional. About one third of those using the Internet for health reported that using the Internet affected a decision about health or their health care, but very few reported impacts on measurable health care utilization; 94% said that Internet use had no effect on the number of physician visits they had and 93% said it had no effect on the number of telephone contacts. Five percent or less reported use of the Internet to obtain prescriptions or purchase pharmaceutical products.

Conclusions Although many people use the Internet for health information, use is not as common as is sometimes reported. Effects on actual health care utilization are also less substantial than some have claimed. Discussions of the role of the Internet in health care and the development of policies that might influence this role should not presume that use of the Internet for health information is universal or that the Internet strongly influences health care utilization.

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THE INTERNET HAS BEEN RECOGnized for many years as an important, if concerning, mechanism for transforming medical care.[1-6] While questions remain about its limitations,[7] concerns regarding misinformation,[3,8-13] and potential difficulties with the confidentiality of personal information,[14,15] the Internet appears to have promise as a means to disseminate information about health and health care, enhance communication, and facilitate a wide range of interactions between patients and the health care delivery system. These kinds of changes could produce important improvements in health care and, ultimately, the health of the population. Understanding the extent to which the Internet is being used for health purposes and the effects it has on health care use would help identify the extent to which these benefits are being realized and provide a context for fruitful discussions of the current and future role of the Internet in health care.

Commonly cited estimates suggest that more than half[15-17] and as much as 80%[18-20] of adults with Internet access use it for health care purposes. Many of those who use the Internet for health purposes are reported to use it frequently. These estimates have been widely disseminated and now frequently form the context for discussions among the media and others of the role of the Internet in health care.[21-28] However, other, perhaps less well-publicized reports suggest much lower rates of use.[14,29,30] Comparing existing estimates can be difficult because details on aspects such as selection or nonresponse bias are frequently

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not presented in the reports, many of which appear online or as private releases rather than in peer-reviewed journals.

The wide variation in estimates of the extent of Internet use for health, coupled with the fact that the highest estimates have been the most widely disseminated, makes it difficult to focus discussions about the role of the Internet in health care and develop appropriate responses. Clearer information is needed as a foundation for future steps. This article reports results from a survey that measures the extent of Internet use for health care among a large, well-defined, representative sample of the US population.

We also examined the prevalence of e-mail use for health care. Previous literature expresses both optimism and concern about the use of e-mail for patient-physician communication.[31-33] Reports based on surveys of limited sets of patients cite widespread access to e-mail and generally favorable attitudes toward it,[34,35] but few studies identify the prevalence of e-mail use in practice.[36] Finally, we examined the effects that Internet and e-mail use has on users' knowledge about health care topics and their use of the health care system.

METHODS

During December 2001 and January 2002, we surveyed a nationally representative sample of the US population aged 21 years or older about their use of the Internet and e-mail for health. We drew our sample from a research panel of more than 60 000 households developed and maintained by Knowledge Networks (Menlo Park, Calif), a survey research firm. To construct the panel, Knowledge Networks used random-digit dialing to contact potential panel households, inviting them to join the research panel. To facilitate surveying the panel and to create an incentive for participation, they provide all households in which an individual agrees to participate in the panel with free Internet access via WebTV (Microsoft Inc, Redmond, Wash). Surveys of individuals from the panel are conducted using the Internet. The ability of this research panel to support nationally representative analyses has been studied in a number of ways, all of which substantiate its validity. We conducted specific tests of the validity of the survey sample used for this study, which showed that it tracks key indicators from other major national surveys. (These analyses are reported in an appendix to this article that is available from the authors.) Our survey was sent to 12 878 individuals consisting of a random sample of adults aged 21 years or older and random oversamples of individuals aged 50 or older and veterans. Responses were obtained from 8935 (69.4%) of those surveyed. We use post-stratification weights, which correct the distribution of respondents to match the known distribution of the US population on age, sex, race, education, region, metropolitan residence, and veteran status, to account for the oversamples and for nonresponse.

Previous studies have typically reported rates of Internet use for health care among respondents with Internet access. All of the members of our sample have Internet access because all have the WebTV provided by Knowledge Networks. Because our sample contains individuals who did not obtain Internet access on their own, as a whole it is probably not directly comparable with samples with Internet access analyzed in other studies. To provide comparable information, we analyzed the subgroup of our sample who reported that they had used the Internet before they were given WebTV. We expect this group of "Internet users" to be comparable with those identified in other studies as Internet users. Of the 8935 survey respondents, 4764 reported using the Internet before getting WebTV.

The survey contained an extensive set of questions about use of the Internet and e-mail for health care information and the perceived effects of Internet or e-mail use on health care use. In some sections, respondents who self-reported having any of 5 chronic conditions were asked questions specific to their condition. The 5 conditions were heart problems (defined as a "heart attack," coronary heart disease, angina, heart failure, or other heart problems), cancer, diabetes, hypertension, and depression. Respondents who indicated having more than 1 condition were randomly assigned 1 of the conditions that they indicated for the condition-specific questions. Comparisons of Internet and e-mail use among patients with different conditions are presented elsewhere.[37]

We analyzed responses using standard tabulations. We used logistic regression analyses to investigate the relationships between Internet and e-mail use for health care and age, sex, annual household income, education, self-reported health status, and residence in a Metropolitan Statistical Area. These models exclude cases with missing data for household income and self-reported health status. Standard errors in the regressions are adjusted for the complex survey design. Analyses were performed using Stata (Stata Corp, College Station, Tex). $P<.05$ was considered statistically significant.

RESULTS

Prevalence of Internet and E-mail Use for Health Information

Our analysis sample included 4764 individuals who responded to the survey and who reported that they had used the Internet before receiving the WebTV service. TABLE 1 describes the demographic characteristics of the sample.

The survey asked 4 main questions about use of the Internet and e-mail for health care purposes in the last year (TABLE 2). Approximately 40% of Internet users in our sample reported that they used the Internet for information or advice about health or health care during the past year. Next most common was use of e-mail or the Internet to communicate with family or friends about health in the past year. Use of e-mail or the Internet to communicate with a health care professional or with other people who have similar health conditions or concerns was less common.

Among those who use the Internet for health care, use was relatively infrequent. Thirty-one percent of respondents (who comprised 78% of those who reported ever using the Internet for

health) said they used the Internet for health every 2 to 3 months or less. Only 9% of respondents (22% of those who said they used the Internet for health) said they used the Internet once a month or more. Similar frequencies were observed for use of e-mail.

Table 1. Sample Characteristics of Internet Users (N = 4764)*

	Weighted %
Age, y	
21-34	32.7
35-49	38.1
50-64	21.3
65-74	5.8
≥75	2.1
Mean (SD)	42.5 (13.7)
Male sex	47.2
Household income, $	
<25 000	21.2
25 000-49 999	34.5
50 000-74 999	23.5
≥75 000	20.7
Education, y	
≤12	41.4
13-16	49.1
>16	9.6
Health status	
Excellent/very good	54.8
Good	34.3
Fair/poor	11.0
Residency	
Urban	79.9
Nonurban	20.1
Chronic conditions†	
≥1	43.7
0	56.3

*Because of item nonresponse, unweighted n = 4280 for income distribution, 4760 for health status distribution, and 4756 for chronic condition distribution.
†The 5 chronic conditions inquired about are heart problems, cancer, diabetes, hypertension, and depression.

We examined the relationship between the use of e-mail and use of the Internet for health. Fifty percent of respondents said that they had used the Internet or e-mail in at least 1 of the 4 measured ways. Of these, 42% reported using the Internet for health information without use of e-mail. Rates of e-mail use were notably higher among those who reported Internet use for health. Forty-seven percent of those who reported Internet use also reported using e-mail for 1 or more of the 3 measured purposes as opposed to 16% of those who did not report using the Internet. Specific examination of the association between health Internet use and e-mail communication with physicians showed that 10% of those who reported Internet use also reported e-mail communication with a physician as opposed to 3% of those who did not report Internet use.

Demographics and Internet Use for Health

TABLE 3 reports results from logistic regression analyses that examined the relationships between respondent demographics and Internet and e-mail use for health. Individuals aged 75 years or older were much less likely to report use of the Internet for health than younger individuals. The odds of use for men were about half of the odds for women ($P<.001$). We observed strong relationships between higher education levels and higher rates of Internet use for health but no strong relationship with income. Respondents who self-reported worse health status were more likely to report using the Internet for health and health care.

There were no significant demographic relationships for the rate of making e-mail contact with a physician or other health care professional, for which the rate of any use was low in general. Relationships between demographics and rates of e-mail contact with family or friends were similar to those found for Internet use for health. When we examined use of e-mail or the Internet to contact others with similar health concerns, we found no trend toward less use with age and a weak relationship with education. Higher-income households were less likely to use e-mail or the Internet to contact others with similar health concerns, and individuals reporting worse health status were more likely to do so.

Effects of Internet Use on Health Care

We asked respondents who reported that they had ever used the Internet or e-mail for health purposes a series of questions about the effects of Internet or e-mail use on their knowledge about health care issues and their use of health care. Those who indicated having heart problems, cancer, diabetes, hypertension, or depression were asked questions about the effects of the Internet or e-mail specific to their condition. Those who did not indicate having 1 of these conditions were asked more general questions. These questions were phrased so that respondents could indicate that they strongly agreed, agreed, disagreed, or strongly disagreed that the Internet or e-mail had various effects. TABLE 4 reports the percentages of respondents who strongly agreed or agreed that use of the Internet or e-mail had the indicated effect. Among those without any of the 5 chronic conditions, 67% said that use of the Internet improved their understanding of health care issues, but fewer

Table 2. Prevalence and Frequency of Internet and E-mail Use for Health Information*

	Frequency of Use, Weighted %					
In the Past Year, About How Often Did You	Ever in Last Year	More Than Once/wk	About Once/wk	Once/mo	Every 2-3 mo	Less Than Every 2-3 mo
Look on the Internet for information or advice about health or health care? (n = 4760)	39.7	1.6	2.2	4.8	6.1	25.0
Use e-mail or the Internet to communicate with a doctor or other health care provider? (n = 4737)	6.0	0.8	0.4	0.6	0.9	3.3
Use e-mail or the Internet to communicate with a family member or friend about health or health care? (n = 4734)	25.5	1.5	2.0	3.3	3.9	14.8
Use e-mail or the Internet to communicate with other people who have health conditions or concerns like yours? (n = 4722)	11.2	0.8	1.1	1.6	1.5	6.3

*Data are shown as weighted percentages of responses in each category. Sample sizes differ across questions because of item nonresponse.

respondents said that the Internet affected more substantive decisions or activities such as improving their ability to manage their health care needs on their own or influencing their choice of health care professional. We obtained similar results among those with 1 or more of the chronic conditions. About half of these respondents indicated that use of the Internet improved their understanding of their chronic condition, treatments for their chronic condition, or other symptoms, conditions, or treatments, while the percentage indicating effects on decisions about health or health care or on use of the health care system ranged from 7% to 32%.

Two questions specifically asked about effects of Internet use on contacts with the health care system (TABLE 5). Respondents were asked about the effect of Internet or e-mail use in the last year on the number of times they had visited or telephoned a physician or other health care professional. In both cases, more than 90% of respondents indicated that use of the Internet or e-mail had no effect on the number of contacts.

Use of the Internet for Prescription Drugs

We asked respondents who self-reported that they had taken a prescription medication in the past year several questions about their use of the Internet for prescription drugs (TABLE 6). Five percent or less said that they used the Internet to obtain prescriptions either from their physician or from an online physician whom they had not seen in person, purchase prescription drugs, or search for the cheapest place to buy a prescription drug. Thirty-three percent indicated that they had used the Internet or e-mail to learn more about a prescription drug.

COMMENT

Extent and Frequency of Internet Use for Health

We estimate that approximately 40% of the adult US population with Internet access used the Internet for information or advice about health or health care in 2001. About half of the adult US population uses the Internet at all,[29] suggesting that about 20% of the entire adult population in the United States used the Internet for health care purposes in 2001. These numbers are substantially lower than the rates of Internet use for health care that are often reported. Highly publicized reports have suggested that a majority and, in some reports, even as many as 80% of US adults with Internet access use the Internet for health care purposes.[15,16,18-20] However, our results are consistent with other, perhaps less widely publicized reports of 35% to 37% in recent years.[14,29]

We also found that Internet use for health is relatively infrequent. Seventy-eight percent of those who ever used the Internet for health care in 2001 reported using it every 2 to 3 months or less. Only 22% of those who ever used the Internet reported using it once a month or more. Again, our estimates are much lower than those reported in other studies. One recent report indicated that 59% of adults who search for health information online do so about once a week to once a month.[15] In another report, the mean number of times per month users said they looked for

Table 3. Use of Internet for Health Information by Demographic Characteristics*

	Search for Health Information on the Internet		E-mail Physician		E-mail Family/Friends		E-mail Others	
Characteristics	Odds Ratio (95% Confidence Interval)	*P* Value	Odds Ratio (95% Confidence Interval)	*P* Value	Odds Ratio (95% Confidence Interval)	*P* Value	Odds Ratio (95% Confidence Interval)	*P* Value
No. of observations	4274		4259		4256		4247	
Age, y								
35-49	1.1 (0.8-1.4)	.60	0.8 (0.5-1.4)	.52	0.9 (0.6-1.2)	.33	1.0 (0.6-1.5)	.87
50-64	1.1 (0.8-1.4)	.65	0.7 (0.5-1.2)	.19	0.9 (0.7-1.2)	.57	0.9 (0.6-1.4)	.78
65-74	1.2 (0.8-1.6)	.41	0.5 (0.3-1.0)	.07	0.8 (0.6-1.2)	.38	0.8 (0.5-1.4)	.47
≥75	0.6 (0.4-1.0)	.048	0.7 (0.3-1.6)	.44	0.9 (0.5-1.6)	.74	1.3 (0.6-2.7)	.44
Male sex	0.5 (0.4-0.6)	<.001	1.1 (0.7-1.7)	.55	0.6 (0.5-0.8)	<.001	0.7 (0.5-1.0)	.08
Household income, $								
25 000-49 999	1.0 (0.7-1.4)	.96	0.7 (0.4-1.2)	.17	0.8 (0.6-1.1)	.15	0.7 (0.5-1.2)	.18
50 000-74 999	0.9 (0.7-1.2)	.56	0.5 (0.3-1.0)	.06	0.8 (0.5-1.1)	.12	0.4 (0.2-0.6)	<.001
≥75 000	1.1 (0.8-1.5)	.53	0.7 (0.4-1.3)	.27	0.9 (0.6-1.3)	.55	0.5 (0.3-0.8)	.004
Education, y								
13-16	2.0 (1.6-2.5)	<.001	1.2 (0.8-2.0)	.39	1.4 (1.1-1.8)	.005	0.9 (0.6-1.3)	.50
≥17	2.8 (2.0-3.9)	<.001	1.4 (0.8-2.5)	.21	2.5 (1.7-3.5)	<.001	1.1 (0.7-1.7)	.70
Resident of MSA	1.2 (0.9-1.6)	.15	1.0 (0.5-1.7)	.86	0.9 (0.6-1.2)	.38	0.9 (0.6-1.4)	.62
Health status								
Good	1.1 (0.9-1.4)	.39	1.4 (0.9-2.2)	.18	1.5 (1.1-1.8)	.003	1.3 (0.9-1.9)	.12
Fair/poor	1.8 (1.3-2.5)	<.001	1.4 (0.8-2.6)	.29	2.3 (1.6-3.2)	<.001	2.1 (1.3-3.4)	.004

Abbreviation: MSA, Metropolitan Statistical Area.
*Models contain an intercept. Referent categories are as follows: age 21 to 34 years; female sex; household income under $25 000; 12 or fewer years of education; nonresidence in an MSA; and excellent/very good health status.

health information online was 3, and the median was 1.2.[18] Our results cannot be directly compared with these results, but our results imply a median number of uses per month much lower than 1.2.

One plausible explanation for the differences in reported use rates is differences in the samples. Some previous work, including the surveys that report the highest rates of Internet use for health care,[19,20] is based on samples developed by using online recruitment. Other previous work used telephone surveys. One possibility is that the samples used in these studies overrepresent individuals who are particularly enthusiastic about the Internet and who might be both more likely to use it for health information and more willing to participate in surveys about it. Although we cannot unequivocally rule out the existence of selection bias in our own sample, our analyses of the sample are consistent with the view that it is representative of the population of the United States and, thus, we do not expect that selection bias is likely to have significantly influenced our results.

Although sample differences are a plausible explanation, we cannot provide specific evidence about their relative importance. Other possible explanations include differences in the wording of questions and the presentation of the survey. We believe that our question about Internet use for health provides a wide scope for an affirmative answer and is thus likely to capture a broad range of use and unlikely to lead us to underestimate use, but our question did ask about Internet use in the past year, and some other surveys are less precise about the time frame to which questions pertain. For example, a recent Harris Poll asked, "How often do you look for information online about health topics—often, sometimes, hardly ever or never?"[18] Differences in the specification of the time frame could play a role in the variations in the findings, although the comparable questions on other prominent surveys generally appear to refer to current use patterns, which may not imply a time frame substantially different than the past year.

It is tempting to interpret a finding that 40% of adults with Internet access use the Internet for health care information—much lower than common previous reports—as disappointing news for the Internet. It is not clear to us that this is the case. Although the Internet existed a decade ago, very few people would have used it then for health care purposes. That the number of people using the Internet for health has grown to include 40% of online adults could easily be viewed as a success. A useful point of comparison is reported rates of Internet use for other activities. Results from the US Census Bureau's Current Population Survey, a highly regarded regular survey of the US population, suggest that about 62% of online adults use the Internet to check news, weather, or sports information; 42% play games online; and

Table 4. Perceived Effects of Internet or E-mail Use on Health Care Understanding and Decisions*

Effect of Using the Internet or E-mail	No. of Respondents	Agree or Strongly Agree, Weighted %
Among Respondents With None of 5 Chronic Conditions		
Improved my understanding of symptoms, conditions, or treatments in which I was interested	1119	67
Improved my ability to manage my health care needs without visiting a doctor or other health care provider	1112	30
Led me to seek care from different doctors or other health care providers than I otherwise would have	1104	12
Affected the way I eat or exercise	1115	27
Among Respondents With ≥1 of 5 Chronic Conditions		
Improved my understanding of [condition]	1382	48
Improved my understanding of possible treatments for [condition]	1378	46
Improved my understanding of other symptoms, conditions, or treatments in which I was interested	1396	58
Affected treatments I am using for [condition]	1364	16
Improved my ability to manage my [condition] by myself	1359	27
Improved my ability to manage other health care needs without visiting a doctor or other health care provider	1375	30
Led me to seek care from different doctors or health care providers for [condition] than I otherwise would have	1360	7
Affected the way I eat or exercise	1370	32

*Questions were asked of those who said that they had used the Internet to look for information or advice about health or health care; used e-mail or the Internet to communicate with a provider, friend, family member, or other person with similar health care concerns; or used the Internet for any purpose related to prescription drugs. The full question preamble was, "Thinking overall about all of the times in the last year that you used the Internet or e-mail for things related to health or health care, to what extent would you agree or disagree with the following statements? Using the Internet or e-mail . . ." Response choices on a 4-point Likert scale were strongly agree, agree, disagree, strongly disagree. Condition was specified as heart problems, diabetes, cancer, hypertension, or depression based on the chronic condition(s) the respondent indicated. Sample sizes are unweighted; percentages are weighted.

Table 5. Perceived Effect of Internet Use on Physician Visits and Telephone Calls*

Did Using the Internet or E-mail Affect Either of the Following?	Weighted %		
	Increased	No Effect	Decreased
No. of times visited a physician or other health care provider	3	94	3
No. of times telephoned a physician or other health care provider	2	93	5

*Data are shown as weighted percentages of responses in each category. Questions were asked of those who said that they had ever used the Internet to look for information or advice about health or health care; used e-mail or the Internet to communicate with a provider, friend, family member, or other person with similar health care concerns; or used the Internet for any purpose related to prescription drugs. Unweighted sample sizes are 2548 and 2553, respectively, for the 2 questions. The full question preamble was, "Thinking overall about all of the times in the last year that you used the Internet or e-mail for things related to health or health care, did using the Internet or e-mail affect either of the following?"

39% shop online.[29] At the lower end, 18% report using the Internet for banking or paying bills, 17% report accessing chat rooms or listservs, and 9% report trading stocks online. In this context, a utilization rate of 40% seems relatively high.

One intuitive interpretation of a utilization rate of about 40% is that the Internet holds the most promise for a subset of the population. There are a number of sources of health information available to interested individuals, of which the Internet is one. Optimal results for health care delivery are most likely to be achieved if individuals seek information from the source that is most effective for them, and that source may not be the Internet for everyone, not even for everyone with Internet access. It may not be reasonable to expect that everyone with Internet access will use the Internet for health care or that encouraging everyone with Internet access to use it for health care information would be the best course of action. This, though, would not mean that the Internet is not highly valuable for the subset of the population that uses it.

Some particular challenges are highlighted by our analysis of the relationships between demographics and Internet use for health care. In particular, we find that individuals with less education are less likely to use the Internet for health care. These findings parallel more general findings about the prevalence of Internet use for any reason[29] and raise important questions about the ability of the Internet as currently structured to provide benefits to populations that need health information and potentially have a difficult time getting it.

Overall, these findings suggest that discussions about using the Internet for health care should be calibrated to account for a lower prevalence and lower frequency of use than often reported. Actions taken based on the presumption that frequent Internet use for health is the rule rather than the exception could be misdirected.

E-mail Use for Health Care

E-mail use in general is widespread, with nearly all online adults reporting its use.[16,29] Our results, though, show little use of e-mail in patient-physician communications. We estimate that 6% of US adults with Internet access used e-mail to communicate with a health care professional in 2001, consistent with other reports suggesting limited use in practice.[16,36]

Other forms of communication facilitated by e-mail should not be overlooked in discussions of the role of online activities in health. About one quarter of Internet users said that they used e-mail to communicate with family or friends about health issues, which could facilitate better access to or information about health care. Although the number was smaller, some also said that they used e-mail or the Internet to communicate with other patients. Studies show that information sharing can help patients in at least some situations.[38-40]

Table 6. Internet Use for Prescription Drugs*

Ever Use of E-mail or the Internet in Past Year to	Yes, Weighted %
Get a prescription from participant's own physician	2
Get a prescription from a physician that respondent has never seen in person	<1
Purchase prescription drugs	5
Learn more about a drug	33
Search for the cheapest place to buy prescription drugs	4

*Questions were asked of those who said that they had taken any prescription medication in the past year. Unweighted sample sizes are 3668, 3667, 3668, 3670, and 3649, respectively. The full question preamble was, "In the past year, did you ever use e-mail or the Internet to . . . ?" Response options were "yes" or "no." Percentages are weighted.

Effects of Using the Internet on Health Knowledge and Health Care Use

The Internet and e-mail could influence health care through a variety of channels. One key way is by enhancing the provision of information. This may provide intangible benefits like making patients more comfortable or confident about their care. It may also produce more tangible effects on their use of health care. Information gleaned from the Internet may improve patients' ability to interact efficiently and productively with health care professionals. In some cases, it may make them better able to care for themselves and reduce the need to consume expensive health care resources with problems that can be managed without additional help. Of course, it is also possible for the Internet to provide information that would reduce the well-being of patients. Previous work has frequently pointed out wide variations in the quality of information available on the Internet.[3,8-13] Erroneous or poorly targeted information may lead to poor treatment choices. An overabundance of extraneous, irrelevant, or invalid information may place new burdens on health care professionals and detract from their ability to provide care efficiently.

Consistent with some other work,[15,41] our results suggest that Internet users can find information they consider useful on the Internet. The majority of respondents indicated that using the Internet or e-mail improved at least some aspect of their knowledge about health care issues. This appears to be an encouraging sign of the ability of the Internet and e-mail to benefit patients, although some further information would be valuable. First, since there are not clear benchmarks for the number of users who should be able to benefit from use, it is not clear whether the results we observe are objectively high or low. On one hand, perhaps it is reasonable to expect that the Internet should be able to provide at least some valuable information to almost everyone who seeks information online. On the other hand, perhaps many users already have a good understanding of their issue of interest when they use the Internet. Second, although it is tempting to infer that the well-being of users who find information they consider useful online will have been improved, this is not necessarily true. Our study did not have the ability to identify the objective quality of the information found by users, nor did this study determine whether In-

ternet use provided information to users that they would not otherwise have obtained as opposed to simply substituting for other information sources.

In contrast with some other reports,[15] our results suggest that the Internet is much less frequently an influence on health care utilization, such as by affecting treatments used or making respondents more able to manage conditions on their own. More than 90% of respondents said that using the Internet had no effect on either physician visits or telephone contacts.

As a whole, these results suggest that the Internet does function as a means for informing consumers about health and health care, although there may still be room for improvement. Effects on actual decisions are less common, and effects on actual health care utilization are very limited. Discussions of the role of the Internet should not presume that it is now regularly having strong impacts on actual health care utilization.

Prescription Drugs

The role of the Internet in prescription drug markets is increasingly discussed. The Internet may be a useful way to facilitate the purchase of prescription drugs, improving convenience for patients and saving money. It may also undermine traditional pharmacy practices designed to maintain safety, with patients seeking prescriptions from online physicians with limited information on their clinical characteristics. Our results show that the practical reality of either of these positions is currently very small. Although some respondents report that the Internet is a source of information about prescription drugs, almost no one indicated obtaining prescriptions or purchasing prescription drugs online.

CONCLUSION

We found evidence of moderate rates of use of the Internet for health care among adult Internet users, moderate effects of the Internet on the knowledge of users, and very small effects on actual use of office visits, telephone calls to health care professionals, and pharmaceutical purchases. Nonetheless, the Internet clearly is an important tool with the potential to improve information dissemination and perhaps to improve health care delivery and outcomes. Continuing efforts to maximize the potential of this tool could have great value.

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Acquisition of data: Baker, Wagner, Singer, Bundorf.
Analysis and interpretation of data: Baker, Wagner, Singer, Bundorf.
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Primary care redesign ideas are relatively easy to formulate; implementing these ideas in a clinically thoughtful manner is far more difficult.

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RESEARCH LETTER

Carbon Monoxide Poisoning From Industrial Coffee Extraction

To the Editor: The process of commercial coffee roasting releases large amounts of carbon monoxide (CO),[1] which sometimes reach life-threatening levels.[2] We report a case of a death due to CO poisoning sustained during commercial coffee roasting.

Report of a Case. A 23-year-old employee of a roasting plant collapsed and lost consciousness soon after entering a storage tank (approximately 2 m in diameter and 2.7 m in height) to retrieve a tool that he had dropped into the tank. When removed from the tank 40 minutes later, he was found to be in a state of cardiopulmonary arrest and was transported to the hospital. Resuscitation attempts, including cardiac compression and administration of 100% oxygen, were unsuccessful.

Five coworkers also were transported to nearby hospitals. Three of these had collapsed and lost consciousness when they went inside or approached the tank, while 2 others reported presyncopal symptoms. All 5 recovered soon or within a few hours, although 1 was hospitalized and given oxygen.

The medicolegal autopsy of the deceased worker was performed in our department 17 hours after the death. A cherry-red discoloration was seen on the back. Slight bruises were found on the left temporal area and the left forearm. Multiple petechial hemorrhages were observed in the pericardium and on lung surfaces. Both lungs showed severe edema and congestion. The concentration of CO hemoglobin (COHb) was 26% in the heart blood. No other toxic gases or drugs were detected. The cause of death was determined to be acute CO poisoning.

According to the result of the subsequent forensic inspection, the company involved in this incident uses an extracting process on coffee beans that have already been roasted and ground. This process, which is widely used in the industry, involves adding water to ground beans in an extracting tank to produce a coffee extract that is then transferred to a storage tank.

Air samples from storage tanks were collected throughout the roasting process for the determination of CO levels. In this case, the maximum levels of CO in the storage tank were found to be 10 000 to 100 000 ppm. An ambient CO concentration of 5000 to 10 000 ppm can lead to a COHb saturation of as high as 75% (a lethal level) within a few minutes.[3]

Comment. Industrial coffee extraction may place workers at risk of CO poisoning. Workplace standards, improved industrial systems, and better worker education may help to reduce this risk.

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CORRECTIONS

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Incorrect Wording and Data: In the *JAMA*-EXPRESS Original Contribution entitled "Clinical Features and Short-term Outcomes of 144 Patients With SARS in the Greater Toronto Area" published in the June 4, 2003, issue of THE JOURNAL (2003;289:2801-2809), 2 errors occurred on page 2804. The second full sentence in the first column should have read "... or because they did not meet the case definition requiring admission." Also, in the second full paragraph under "Treatment and Associated Toxicities," the second sentence should have read "Sixty-two patients (49%) experienced a decrease in hemoglobin level of at least 2 g/dL after ribavirin was initiated."

Author Name Missing From Byline: In the Original Contribution entitled "Response to Smallpox Vaccine in Persons Immunized in the Distant Past" published in the June 25, 2003, issue of THE JOURNAL (2003;289:3295-3299), "Kathleen R. Lottenbach, MA" should appear in the byline after "Lihan Yan, MS" and before "Robert B. Belshe, MD." In the author affiliations on page 3295, "and Ms Lottenbach" should be added after "Newman." On page 3299, under "Acquisition of data, Analysis and interpretation of data, Drafting of the manuscript, and Administrative, technical, or material support" "Lottenbach," should be added before "Belshe" and under "Study supervision" ", Lottenbach" should appear after "Newman."