

Growth and Determinants of Access in Patient E-mail and Internet Use

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Objectives: To measure the rate of access to and use of the Internet and e-mail, to determine sociodemographic predictors of access, and to measure the change in Internet and e-mail access over a 1-year interval.

Design: Survey study. Comparison of data with those from a similar survey from 1998.

Setting: Emergency department of a large urban pediatric teaching hospital.

Participants: Primary caretakers of pediatric patients or the patients themselves if aged 16 years or older.

Main Outcome Measures: Use of and access to the Internet or e-mail.

Results: We surveyed 214 individuals: 72.8% use or have access to the Internet, e-mail, or both, an increase from 52.2% in the 1998 survey ($P < .001$), and 48.5% regularly use the Internet or e-mail, compared with 43.1% in

1998 ($P = .32$). Outside the home, access is primarily at work (52.2%), schools (8.9%), public libraries (11.5%), and friends' and relatives' houses (16.7%). Internet use and access are linearly correlated with income ($r = 0.43$; $P < .001$). White patients are more likely to have access (odds ratio, 2.6; 95% confidence interval, 1.3-5.4; $P < .001$) than black or Asian patients, whereas those of Hispanic ethnicity are less likely to have access (odds ratio, 0.20; 95% confidence interval, 0.09-0.43; $P < .001$). However, after adjustment for race and Hispanic ethnicity, only income was a significant predictor of family access to the Internet and e-mail.

Conclusions: During the past year, many patients have gained access to the Internet and e-mail, although rates of regular use have remained steady. This access is often from outside the home. Furthermore, access is directly related to income and is unevenly distributed across racial and ethnic groups.

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A GROWING number of patients are using e-mail and the World Wide Web (Web) to seek medical information and communicate with health care providers.¹⁻³ Still, medically related uses of the Internet are relatively limited, even as Internet use globally has dramatically increased, with 204 million people now online.⁴ However, this use is not homogeneously distributed across the socioeconomic spectrum or among racial groups.^{5,6} As medical systems, hospitals, and physicians begin offering Internet-based services, they should assess the level of access to the necessary technology among populations in need.^{7,8} Otherwise, patients with limited financial or computing resources may be excluded from enjoying the benefits of medicine on the Web.⁷ Socioeconomic status, race, and health insurance have all been shown to determine social inequities in

health outcomes.⁹⁻¹¹ Ultimately, as effective interventions become available via the Internet, health outcomes may, in part, be determined by access to the Internet.¹²

To study that access, we administered a survey and compared the data with those from a similar study conducted 1 year earlier.⁷ Our investigation had the following specific objectives: (1) to measure the rate of access to and use of the Internet and e-mail, (2) to determine sociodemographic predictors of access, and (3) to measure the change in Internet and e-mail access over a 1-year interval.

RESULTS

SAMPLE CHARACTERISTICS

Of 253 individuals approached, 24 refused to participate, 9 did not fully complete the survey, and 6 were not eligible because the patient was younger than 16

PATIENTS AND METHODS

We conducted a survey in the emergency department of a large urban academic children's hospital. The department cares for 50 000 patients annually and serves the emergency services needs for about 60% of children in the greater Boston, Mass, area. Patients in the emergency department come from the full range of socioeconomic backgrounds. Approximately 20% of the population receive Medicaid, and 15% are uninsured. Participants were enrolled consecutively. To be eligible for enrollment, the respondent had to be (1) the primary caretaker of the patient or (2) the patient if aged 16 years or older. Excluded were those who were acutely ill and required emergency treatment or who did not speak English or Spanish. Patients who spoke only Spanish were interviewed in Spanish. We had approval from the Human Subjects Committee of the Institutional Review Board of Children's Hospital, Boston, Mass (Protocol X98-03-003).

In pilot testing, the survey took approximately 5 minutes to administer. Major subject areas included (1) use of Internet and e-mail resources, (2) access to Internet and e-mail resources, (3) interest in and concerns about Web-based services provided by the hospital, and (4) sociodemographic information. A trained research assistant (S.F.) administered the survey after obtaining verbal informed consent from participants in the emergency department waiting room. Data were collected on Fridays from 11 AM to 3 PM, from February 12, 1999, through April 21, 1999.

The main independent variable was annual family income. The main outcome variable was use of or access to the Internet or e-mail. Secondary outcome variables were access to the Web and e-mail and location of access to the Web and e-mail. Potential covariates measured were race, Hispanic ethnicity, and maternal and paternal educational level.

Survey data were entered into a relational database (Paradox Windows v. 7.0; Borland International, Scotts Valley, Calif). Statistical analysis was performed with statistical software (SAS for Windows release 6.12; SAS Institute Inc, Cary, NC). Results were considered significant at $\alpha = .05$. The χ^2 statistic was used to compare proportions. Spearman coefficients were used for describing correlation. Logistic regression modeling adjusted for race, ethnicity, educational level, and income. In the models, race, income, and educational level were coded as dummy variables. For income, the greater-than-\$60 000 category served as the reference group. All control variables were forced into the models.

Data were compared with those from a similar study conducted 1 year earlier.⁷

years and the accompanying adult was not one of the patient's primary caretakers. The study sample consisted of 214 participants, 86.6% of those eligible. Spanish-language interviews were conducted for 4.7% of the surveys. Respondents to the survey were the mother (80.8%), the father (12.6%), a guardian (0.5%), and the patient

Table 1. Selected Sociodemographic Characteristics of the 214 Participants

Characteristic	Participants, %
Race/ethnicity	
White	52.8
Black	28.0
Hispanic	16.4
Asian	2.8
Annual household income, \$*	
≤20 000	36.7
21 000-40 000	24.0
41 000-60 000	9.2
>60 000	30.2
Mother's education†	
Less than high school	10.0
High school graduate	34.3
Some college	18.9
College degree or higher	36.9
Father's education‡	
Less than high school	9.7
High school graduate	39.3
Some college	10.8
College degree or higher	40.3

*Income data were available for 91.6% of the sample.

†Maternal education data were available for 93.9% of the sample.

‡Paternal education data were available for 86.9% of the sample.

(5.6%). More than half (52.8%) of the participants were white, and 16.4% identified themselves as Hispanic. Participants represented a broad spectrum of parental educational levels and family incomes (**Table 1**).

ACCESS TO THE INTERNET

Overall

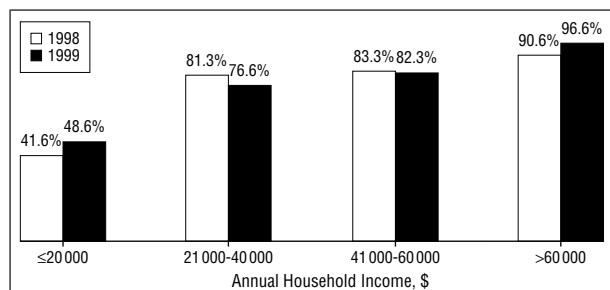
A total of 72.8% of participants use or have access to the Internet or e-mail, an increase from 52.2% in the 1998 survey ($P < .001$). There is a computer or some type of Internet connection at home for 58.9% of respondents, and all but 1.6% of them have a telephone at home. In the 1999 cohort, 48.5% of respondents regularly use the Internet or e-mail, compared with 43.1% in 1998 ($P = .32$). Outside the home, 58.8% have access to the Web or e-mail, with 41.1% having access at school or work. Internet and e-mail access from outside the home is primarily at work (52.2%), schools (8.9%), friends' and relatives' houses (16.7%), and public libraries (11.5%). In 90.5% of households with a computer or some type of Internet connection, other members of the family, besides the respondent, also use the computer. Of respondents with no computer at home, 26.1% intend to buy one within the next 6 months.

World Wide Web

The Web is reported as accessible by 70.1% of respondents, an increase from 36.3% in 1998 ($P < .001$). Of respondents who access the Web, 80% can access it from outside the home, and 84.6% of that group have daily access. The Web had been used specifically for obtaining medical information by 31.3% of the sample.

Table 2. Rates of E-mail Access

	Participants, No. (%)		P
	1998 Cohort (n = 132)	1999 Cohort (n = 214)	
Any access	53 (40.2)	101 (47.2)	.20
Location of access among those with e-mail			
Home	40 (75.5)	70 (69.3)	.42
Home only	17 (32.1)	21 (20.8)	.12
Elsewhere	43 (81.1)	78 (77.2)	.80
Elsewhere only	19 (35.8)	31 (30.7)	.51
Home and elsewhere	17 (32.1)	49 (48.5)	.05



The relation of annual household income to the rate of Internet and e-mail use or access.

E-mail

E-mail accounts are held by 47.2% of respondents compared with 40.1% in the 1998 survey ($P = .20$). Their e-mail accounts are regarded as private by 86.9% of respondents. From home, 69.3% of respondents with e-mail can access their accounts; from outside the home, 77.2% can access their accounts (**Table 2**). Almost half (48.5%) of those with e-mail can read e-mail both at home and elsewhere; this mobility of access is increased from only 32.1% in the 1998 survey ($P = .05$). Of those with e-mail, 27.5% check their accounts more than once a day, 49.0% once a day, 12.7% less than once a day but more than once a week, 6.9% only once a week, and 3.9% less than once a week. In 18.2% of families, a second caretaker also had access to e-mail at home. Only 3 families (1.4%) had used e-mail or the Web to communicate with their primary pediatricians.

SOCIODEMOGRAPHIC DATA AND ACCESS

Figure 1 shows that 1998 and 1999 use and access are linearly correlated with income ($r = 0.43$; $P < .001$). The larger number of respondents in the lowest and highest income groups drive the substantial increase in overall use and access rates. Overall use and access also correlate with maternal ($r = 0.41$) and paternal ($r = 0.42$) educational level ($P < .001$ for both). Regular use of the Internet and e-mail correlate with income ($r = 0.49$), maternal educational level ($r = 0.42$), and paternal educational level ($r = 0.42$) ($P < .001$ for all).

White patients were more likely to use or have access to the Internet and e-mail (odds ratio [OR], 2.6; 95%

confidence interval [CI], 1.3-5.4; $P < .001$) than were black or Asian patients, whereas those of Hispanic ethnicity were much less likely (OR, 0.20; 95% CI, 0.09-0.43; $P < .001$). However, in logistic regression models, which included race, Hispanic ethnicity, and income, only income was a significant predictor of family access to the Internet and e-mail. For a family with an annual income of \$20 000 or less, the OR (with the $> \$60\,000$ category as the reference group) was 0.10 (95% CI, 0.02-0.60). For those with an income of \$21 000 to \$40 000, the OR was 0.20 (95% CI, 0.03-1.01; $P = .05$).

PATIENT ATTITUDES TOWARD INTERNET-BASED SERVICES

More than half (56.5%) of respondents indicated that they would be interested in using the Internet or e-mail to receive follow-up information about their child after an emergency department visit, and those with Internet or e-mail access were much more likely to be interested (OR, 5.5; 95% CI, 2.8-10.7; $P < .001$). Of those who were not interested in receiving such services, their most commonly expressed concerns were (1) "other people that I know might see my test results" (6.5%), (2) "other people that I don't know might see my test results" (6.5%), (3) "I do not have access to the Internet or to e-mail" (53.8%), (4) "the system might not be reliable" (1.1%), (5) "the system would not be convenient for me" (1.1%), and (6) "I want my primary care provider to be informed of the communication" (2.2%).

COMMENT

Almost three quarters of our diverse population report access to the Internet or e-mail, a dramatic 40% increase over the 1998 access rate. Even among families with an annual income of \$20 000 or less, nearly half reported access, a rate higher than that found in 1998 and higher than that reported in another cohort of disadvantaged patients.⁸ Nearly all families with annual incomes greater than \$60 000 report access to the Internet or e-mail. Most patients have home computers and are interested in Internet-based services for follow-up care after their encounters.

Even so, connectivity is directly correlated with family income and is distributed unevenly across racial and ethnic groups. Despite overall increasing access, many of the economically disenfranchised remain disconnected. But this may change. Computer prices are decreasing, putting them in reach of a growing number of people. Affordable set-top boxes that allow e-mail and Internet access using a standard television, and powerful inexpensive personal computers, are now readily available. Even standard television sets will soon have Web browsing capabilities. Penetration of this technology into the home will likely parallel that of color television sets, found in 97% of American homes.¹³ In addition, if effective health care interventions are being provided via the Internet, then provision of equipment or Internet service to the shrinking minority of patients without access may be cost-efficient and feasible.

Rates of access exceed rates of use. Among patients who have access, about two thirds actually use Internet and e-mail. People who have not yet purchased computers, or learned to navigate the Web, may have these new technologies available at school and at work. The availability of Web-based health care applications may motivate others to go online. In more than three quarters of families with e-mail accounts, the patient's primary caretaker checks e-mail at least once a day, suggesting that e-mail or Web-based health communication may be practical. In fact, use of e-mail for health communication may encourage more frequent log-ons. Basic education about Internet use will enable patients to exploit the access available to them.

There is increasing mobility of e-mail access, with nearly half of e-mail users able to check e-mail from home and elsewhere, and almost one third only able to check e-mail from outside the home. This finding, that patients will be accessing health applications while on the move, should be informative for software designers. Applications that require a particular piece of software on a desktop machine, or use of a server that is not ubiquitously and securely available, may reach a limited subset. Lightweight applications, such as secure Web clients, accessible from any Web browser, should enable widespread access by all types of users.

Our study was conducted in-person at the point of service for our patient population. As such, it does not have a selection bias against those unable to complete a written survey, and it is not biased against those with no telephone. Carried out at a single center in a metropolitan area, the results may have limited generalizability, although overall access and growth of access in our clinical population is consistent with national polls of US citizens.¹⁴

CONCLUSIONS

During the past year there has been substantial growth in access by a patient population to the Internet and e-mail. Even among low-income groups, nearly half of the participants report availability of the Internet and e-mail at home, school, work, and elsewhere. Although this growth has profound implications for health systems, hospitals, and physicians wanting to offer Internet-based health care services, careful attention must be paid to the determinants of access. Access is

directly related to income and is unevenly distributed across racial and ethnic groups. Social factors, particularly income, limit access of certain groups to these services and may cause disparities in health outcomes as Web-based services become integral to health care provision. Furthermore, health care providers and software engineers should recognize that patients' access to the Web is often from outside the home and that for applications to be effective they should be available to nomadic users of the technology.

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