

# Social Equity and Access to the World Wide Web and E-mail: Implications for Design and Implementation of Medical Applications

Kenneth D. Mandl, M.D., M.P.H, Seth B. Katz, Isaac S. Kohane, M.D., Ph.D.  
Division of Emergency Medicine and Informatics Program  
Children's Hospital, Harvard Medical School, Boston, MA

**Introduction.** *The distribution and types of Internet connectivity will determine the equity of access by patient populations to emerging health technologies. We sought to measure the rates, types, and predictors of access in a patient population targeted for Web-based medical services.*

**Methods.** *Design. Cross sectional in-person interview. Setting. Emergency department of a large urban pediatric teaching hospital. Subjects. Primary caretakers of patients or patients at least 16 years old. Procedure and measures. Subjects were asked about access to e-mail and the Internet as well as about willingness to use and concerns about Web-based services. Views of equity and access and sociodemographic data were also elicited.*

**Results.** *132 subjects were enrolled in the study. Of respondents, 67.2% use a computer and 36.4% can access the Internet or e-mail from home. Including Internet connections and/or e-mail accounts at work, school and public libraries, 50.7% of the sample has access. Forty percent of families have e-mail accounts. The rate at which families have connectivity is primarily correlated with income ( $r=0.6$ ,  $p<0.01$ ). At all income levels, rates of access to the World Wide Web are higher than to e-mail. White patients are much more likely to have e-mail (OR 5.0, 95%CI 2.4-10.8) and Web access (OR 3.6, 95%CI 1.7-7.5).*

**Conclusions.** *Connectivity is directly correlated with income and distributed unevenly across racial and ethnic groups. World Wide Web access is more prevalent than e-mail accounts, and both are often obtained outside the home. Design of health applications should account for these attributes of patient access.*

## INTRODUCTION

A revolution in electronic communication is in process with impressive implications for the doctor-patient relationship and the practice of medicine. (1, 2) Though to date, telemedicine research has been predominantly focused on enhancing exchange among providers, this emphasis is likely to shift to

include patients, as more Americans gain access to the National Information Infrastructure. There are currently over 50 million users of the Internet worldwide.(3)

However, before offering Internet-based medical services, society, medical systems, hospitals, and individual physicians should assess the level of access to this technology among populations in need. Otherwise, patients with limited financial or computing resources may be excluded from enjoying the benefits of medicine on the Web. Race, socioeconomic status, and access to services through health insurance have all been demonstrated to be determinants of social inequities in health outcomes.(4-7) Ultimately, social equity of access to emerging health technologies will be sensitive to the structure and function of Internet-based applications and the distribution of access to the Internet.

We conducted a survey of patients who are the potential recipients of Web-based medical services. We aimed to determine the distribution of various kinds of connectivity in our patient population in order to be able to design applications, administer educational programs, and provide resources that will most equitably enhance care. Our study had the following specific objectives: 1) to measure the rate and types of access to computers and to the Internet; 2) to determine sociodemographic predictors of access; 3) to elicit patient concerns about accessing their own medical information on the Web; and 4) to obtain patients' views on the issue of access and social equity.

## METHODS

We conducted a cross-sectional interview study in the setting of the emergency department of a large urban academic children's hospital. The department sees 50,000 patients annually and serves the emergency services needs for about 60% of children in the greater Boston area. Patients in the emergency department come from the full spectrum of socioeconomic backgrounds. Medicaid serves about 20% of the population and 15% are uninsured.

Subjects were the patients or parents of patients. To be eligible for enrollment, the respondent had to be either 1) the primary caretaker of patient or 2) the patient herself if she were at least 16 years old. Excluded patients were those who were acutely ill and walked back from triage directly into a treatment room, or those who arrived by ambulance and placed directly in an acute treatment room. Patients were also excluded if they could not be interviewed in English. We had approval from our Institutional Review Board's Human Subjects Committee to conduct the survey (Protocol X98-03-003).

Prior to the study enrollment period, the 36-item survey was pilot-tested on 20 patients. The items were assessed for comprehensibility, validity and inter-rater reliability. The survey took approximately 8-10 minutes to administer. Major subject areas included; 1) home computer and Internet resources; 2) computer and Internet resources outside the home; 3) interest in and concerns about Web-based services provided by the hospital; 4) points of view on issues of access and equity; and 5) sociodemographic information.

A trained research assistant administered the survey after obtaining verbal informed consent from patients in the emergency department waiting room. Data were collected two weeknight evenings each week between the hours of 6pm and 11pm, from September 1997 until February 1998. Since volume is high during the evening hours, every third patient registered in the emergency department was approached for consent.

Statistical computations were performed using the SAS System for Windows, Release 6.12, Cary North Carolina. For correlations of access with sociodemographic variables, Spearman's correlation coefficients were used. Odds ratios with 95% confidence intervals were calculated to measure the impact of race and ethnicity on access. Logistic models adjusting for race, Hispanic ethnicity and income, with all variables forced in, were run to determine the significant predictors of access.

## RESULTS

Of 146 subjects approached, four patients refused and 10 were excluded because the patient was under 16 years old and the accompanying adult was not one of the patient's primary caretakers. The study sample consisted of 132 subjects, 97.1% of those eligible. Respondents to the survey were the mother (74.4%), the father (18.4%), a guardian (5.6%), and the patient

(1.6%). Almost 57% of subjects were white and 21.8% identified themselves as Hispanic. Subjects represented a broad spectrum of parental educational level and family income (Table 1).

**Table 1. Selected sociodemographic characteristics of the sample**

	%
<b>Race</b>	
White	56.9
Black	15.4
<b>Hispanic Ethnicity</b>	
	21.8
<b>Annual Household Income \$</b>	
<20,000	28.8
20,000-40,000	22.9
>40,000-60,000	19.5
>60,000	29.7
<b>Mother's Education</b>	
Less than high school	15.6
High school graduate	25.8
Some college	25.8
Completed college	32.8
<b>Father's Education</b>	
Less than high school	15.2
High school graduate	30.4
Some college	13.4
Completed college	41.1

### Access to the WWW and Electronic Mail

A computer is used at least periodically by 67.2% of respondents. A total of 50.7% have access to the Internet or e-mail. The World Wide Web had been used to obtain medical information by 29.5% of the sample. Of the respondents, 40.1% have electronic mail accounts. Of those with e-mail accounts, 86.8% consider the accounts to be private. From home, 31.3% of respondents can access their electronic mail accounts, and 32.5% can access their electronic mail accounts from outside the home. Of those with e-mail access, about one third (31.7%) can read e-mail at both home and elsewhere (Figure 1).

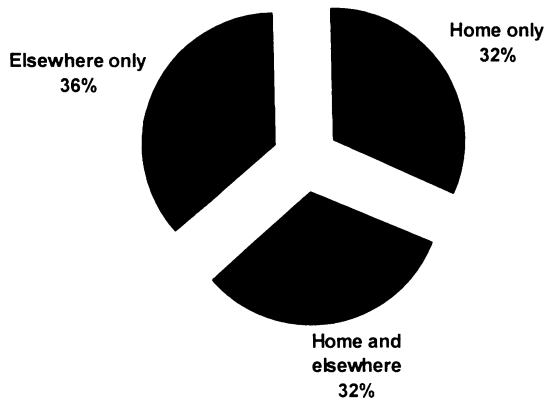


Figure 1. Location of family accesses to e-mail

From home, 36.4% of the sample can access the World Wide Web, and 39.3% can access it from outside the home. World Wide Web and e-mail access outside the home is primarily at work, schools and public libraries (Figure 2). In 11.3% of families, a second caretaker of the child also had Web or e-mail access.

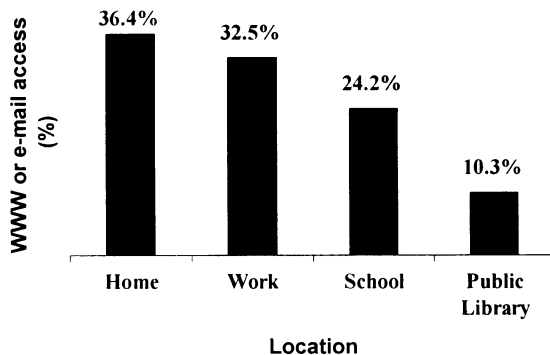


Figure 2. Location(s) of WWW or e-mail access

### Sociodemographics and Access

Family access to e-mail is highly correlated with income ( $r=0.6$ ,  $p<0.01$ ). Access to e-mail is also correlated with maternal educational level ( $r=0.50$ ,  $p<0.01$ ) and paternal educational level ( $r=0.52$ ,  $p<0.01$ ). At each maternal educational level (Figure 3) and family income level (Figure 4) access to the World Wide Web is more prevalent than access to e-mail. Access to the World Wide Web is also directly correlated with income ( $r=0.55$ ,  $p<0.01$ ), maternal educational level ( $r=0.50$ ,  $p<0.01$ ), and paternal educational level ( $r=0.46$ ,  $p<0.01$ ).

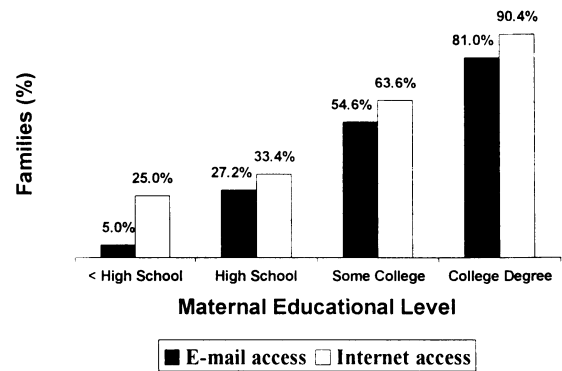


Figure 3. Relationship of e-mail and Internet access to maternal educational level

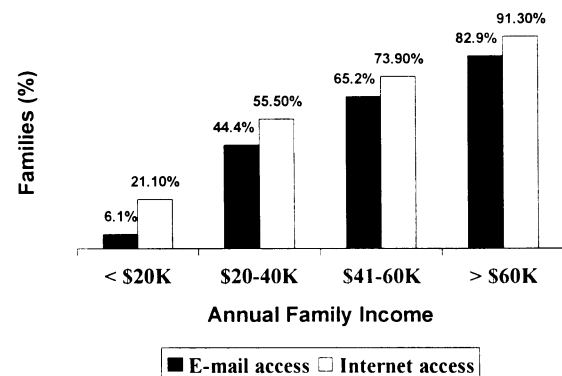


Figure 4. Relationship of e-mail and Internet access to family income

Respondents who identified their race as white were much more likely to have access to e-mail (odds ratio 5.0, 95%CI 2.4-10.8,  $p<0.01$ ) and to the World Wide Web (odds ratio 3.6, 95%CI 1.7-7.5,  $p<0.01$ ). Those of Hispanic ethnicity were much less likely to have access to e-mail (odds ratio 0.2, 95%CI 0.1-0.5,  $p<0.01$ ) and to the World Wide Web (odds ratio 0.2, 95%CI 0.1-0.5,  $p<0.01$ ).

However, in logistic regression models, which included race, Hispanic ethnicity and income, only income was a significant predictor of family access to e-mail and family access to the World Wide Web.

### Views of Services and Social Equity

Just over half of respondents (51.3%) indicated that would be interested in using the Internet or e-mail to receive follow-up information about their child after an emergency department visit. Of those who were not interested in receiving such services, their concerns were: 1) "other people that I know might see my test results" (19.0%); 2) "other people that I

don't know might see my test results" (23.8%); 3) "I do not have access to the Internet or to e-mail" (30.9%); 4) "the system might not be accurate" (2.3%); 5) "the system might not be reliable" (4.7%); and 6) "the system would not be convenient" (23.8%).

Even when explicitly reminded that not all patients have Internet access, 75.7% of subjects thought it would nonetheless "be fair" to offer services through the World Wide Web or e-mail. Even more (79.5%) believed that the services should be offered regardless of whether doing so was "fair." Those respondents who had some form of Internet access were much more likely to think that offering services would be fair (odds ratio 3.2, 95%CI 1.4-7.4,  $p < 0.01$ ). They, however, were not significantly more likely to feel that the services should be offered (odds ratio 2.5, 95%CI 0.9-6.3,  $p = 0.07$ ). Having home e-mail access greatly increased the odds of believing that offering services would be fair despite unequal access (odds ratio 5.5, 95%CI 1.6-19.4,  $p < 0.01$ ).

## DISCUSSION

We found that in a hospital-based population of patients, connectivity is directly correlated with income and distributed unevenly across racial and ethnic groups. These results are consistent with patterns previously reported in nationally representative telephone polls of US citizens.(8, 9) Our data, however, may be more applicable to considerations of health applications development since the study is of a sample of patients and is hospital-based. Further, our design did not have selection bias against patients who have no telephone at home.

In our study, a high proportion of patients both with and without electronic access, believe that medical applications should be made available on the Internet. Those with access were, however, much more likely be convinced that an uneven distribution of connectivity was "fair." Inequitable distribution of a new technology may widen social disparity. An effective therapeutic with differential access according to socioeconomic characteristics or race may cause a divergence in health status outcomes among segments of the population.(4) If electronic mail and other National Information Infrastructure resources were only available to owners of high-end computers, such an effect might be produced.

Our data suggest approaches to application design that could maximize patient access to Internet-based

medical technology. First of all, we found that at all income levels, access to the Web is higher than access to e-mail accounts. Further, not all patients considered their e-mail accounts to be private, and e-mail in accounts issued by employers does not have confidentiality protections. Therefore, applications such as reporting of results directly to patients, which require a particular piece of software on a desktop or the use of a server that is not ubiquitously and securely available, may reach a smaller patient base than would a secure lightweight web client. Furthermore, e-mail addresses and mail directories that are fully controlled by and protected for the patient will encourage greater use of the technology by patients. Of course, the distinction between Web and e-mail access is somewhat artificial, since now HTML e-mail accounts are available free of charge from many Websites. The use of lightweight secure Web clients for medical communications would further minimize this distinction.

Most patients are not yet educated about use of the Internet. Only 10.8% of our sample reported having Internet access at public libraries, though obviously nearly all the patients surveyed actually have such access. In order to ensure widespread use of medical applications, deployment of Web-based technologies will need to be accompanied by intensive patient education programs about Internet and e-mail access, and the use of computers.

We identified many patient concerns that may prevent people from using Internet-based medical applications. Patients were not worried about system accuracy or reliability, but were quite uneasy about confidentiality and ease of access. Adequate systems to authenticate the user, encrypt the communications of data, and cryptographically protect any repositories of patient data and communications are needed. Fortunately, in order to protect electronic commerce, many of these security measures are becoming increasingly robust.

Other forces are at play that could help to even the distribution of Internet access across racial, ethnic, and socioeconomic divides. Although Internet access is skewed toward wealthier, more educated users, strong forces are in play that may shape a substantially more equitable distribution. Multiple industries including telephone companies, cable television providers, technology companies, and mass media conglomerates have identified the "information marketplace" as a major area for investment and development.(10) Set-top boxes, allowing affordable Internet access via standard

television, are now available for a few hundred dollars. Such devices will soon be built into standard televisions. These new forms of connectivity are being fashioned for tasks ranging from selecting a cable channel movie to home banking, to making a purchase from an electronic catalogue. Penetration of this technology into the American home will likely parallel not that of high-end computers, but rather that of other personal electronic items. In 1995, while only thirty-three percent of US homes had personal computers, eighty-five percent had videocassette recorders and ninety-seven percent had color televisions.(3)

### CONCLUSIONS

The direct correlation of Web and e-mail access with income has profound implications for social equity as Internet-based health technology is made available to

patients. While market forces may even the distribution of access over the next few years, other solutions to the equity problem are needed in the mean time. Health care delivery systems offering Internet-based applications for patients should design communications software that ensures confidentiality while being accessible to the maximum number of users by making the software secure, Web-based, and accessible from any Internet-connected information device. When health care systems make Internet-based technology available to patients, they should accompany it with intensive patient education campaigns about Internet access and computer use. In some cases, health systems might consider distributing hardware, software, Internet access, or providing conveniently located kiosks with technology for patients to use.

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