

Crossing the Digital Divide: Evaluating Online Communication Between Patients and Their Providers

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Objective: To address provider, payer, and patient concerns about the use of online communication in healthcare settings by performing a randomized controlled trial of a Web-based patient-provider communication tool in primary care.

Subjects and Methods: Forty-one staff physicians and 91 residents in 4 primary care centers were randomized to a Web-based online communication system. Patients of intervention physicians were encouraged to communicate via the system about health issues, scheduling, prescription renewals, referrals, and billing. Data collected included patient Web use, e-mail use, telephone calls, visit distribution, and physician and patient attitudes toward and satisfaction with communication.

Results: One thousand thirty-eight patients sent 2238 messages during the 40-week study. Half of the messages were directly related to a patient's health; half were administrative. Patient Web use peaked at 8.5 weekly messages per 100 scheduled visits. Patient e-mail and telephone volume remained similar across groups. Intervention physicians reported more positive attitudes toward Web-based communication than control physicians (mean Web benefits scale score, 4.0 vs 1.1; $P = .008$), but there were no between-group differences in attitudes toward communication in general. Patients and physicians reported differential preferences for the use of online communication based on problem complexity and sensitivity.

Conclusions: Web-based messaging was lower than expected because of patient-related factors and limitations of the technology. Patients, physicians, and staff had positive attitudes toward online communication. There was no detectable difference in communication volume between study groups, but more sensitive measures of work burden need to be developed and evaluated.

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Advances in technology have motivated interest in the role of online patient-provider communication in clinical settings. Communicating online could reduce barriers associated with traditional modes of communication,¹⁻⁴ yet it has diffused slowly in clinical practice.⁵ Lack of reimbursement for online communication has motivated questions about whether it will reduce use of other clinic resources or will create additional work for staff.⁶ Providers have voiced concerns about appropriate uses of online communication in clinical practice.⁷⁻⁹ Patients have been reluctant to communicate online because of lack of experience and uncertainty about provider responses.¹⁰ In this issue of the *Journal*, Houston et al¹¹ report as a barrier to use of online communication that adults who used the Web for

health information frequently voiced concerns about bothering physicians. Finally, there is uncertainty about how to build and integrate Web-based communication tools into existing operations and information systems.¹²⁻¹⁴

We built a Web-based patient-provider communication system and performed a randomized controlled trial of its use in an academic primary care setting. The study addressed several questions: Does Web communication between patients and the clinic team substitute for personal e-mail or telephone calls? Does Web-based communication affect patient or provider perceptions of communication? We hypothesized that a Web-based communication tool would reduce e-mail and telephone calls and improve communication between patients and their providers.

METHODS

A randomized controlled trial was performed in 4 university-affiliated primary care clinics for a 40-week period from September 2001 through June 2002. Three faculty physicians and 2 residents declined to participate. Forty-one faculty physicians (averaging 37 scheduled visits per week) and 91 resident physicians (averaging 6 scheduled visits per week) in general medicine and family practice were randomized into 2 groups, intervention ($n = 65$) and control ($n = 67$). The patients of intervention physicians were encouraged to use a secure Web-based tool to communicate with their clinic staff about health and administrative issues and prescription renewals. The Web site had educational content addressing appropriate message content, expected response times, and message handling by clin-

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ic staff. Incoming messages were routed to appropriate clinic staff, who entered the site through a secure log-in. Patients were prompted through regular e-mail to enter the Web site to read responses from the staff. Physicians did not have access to the Web system, and staff contacted physicians for pertinent messages through the usual means. Patients of intervention physicians were encouraged to use the Web system through promotion, including cards distributed by intervention physicians and brochures mailed to patient homes.

Data Collection

Information about the number and types of Web messages was collected from the Web site. E-mail volume was measured based on physician recall of the number of e-mail messages received directly from patients during the previous week. On average, 91.7% of staff physicians responded vs 67.4% of residents. Missing estimates for residents were imputed to zero because feedback suggested that these residents had low e-mail use with patients. Staff logs were used to collect data on telephone call volume by type of call and physician.

Self-administered patient and physician surveys conducted at the end of the study assessed attitudes toward Web and e-mail communication, preferences for different modes of communication, and satisfaction with communication.^{9,10} Because there was no valid physician-patient roster, we selected patients in 2 equally divided groups: 425 patients who had seen an intervention physician 1 or more times and a control physician no more than 1 time during the study period, and 425 patients who had seen a control physician 1 or more times and an intervention physician no more than 1 time during the study period. The Dillman method was used to maximize response rates.¹⁵

Variables and Analysis

Three use variables were constructed at the physician level. These included (1) weekly patient Web messages per 100 scheduled visits (number of patient Web messages per week divided by the mean number of scheduled visits per week during the study period \times 100), (2) weekly patient e-mails per 100 scheduled visits (number of physician-reported patient e-mails per week divided by the mean number of scheduled visits per week during the study period \times 100), and (3) weekly telephone calls per 100 scheduled visits.

Physician survey variables included a "Web benefits" scale that indicated attitudes toward using the Web with patients, with higher scores indicating more favorable attitudes (4 items, $\alpha = .88$), and a general communication scale indicating attitudes toward communication with patients and staff (4 items, $\alpha = .82$). Finally, we

examined preferences for different modes of communication for different clinical issues.

Variables from the patient survey included the following: (1) A Web benefits scale that indicated attitudes toward using Web communication with healthcare providers, with higher scores indicating more favorable attitudes (3 items, $\alpha = .90$). (2) Preferences for different modes of communication using questions similar to those on the physician survey. (3) A general communication scale indicating attitudes toward communication with and access to physicians and staff outside of visits, with higher scores indicating more favorable attitudes (4 items, $\alpha = .85$).

Poisson regression analysis was used to examine differences in trends in counts of the different use measures across the 5 periods between the physician study groups, with physician as the unit of analysis. For example, in one model, telephone volume was the dependent variable, and independent variables included group (intervention vs control), periods (1 through 5), group and period dummy variables, physician status (resident vs faculty physician), and dummy variables indicating study clinic site. Differences in physician and patient attitude scale scores were examined using ordinary least squares regression analysis. The dependent variables were the various scales specified as intervals. Independent variables for the physician scale models included study group, physician type (resident vs faculty physician), and clinic. Independent variables for the patient scales models included study group, age, sex, and clinic. The study was approved by the University of Michigan Institutional Review Board.

RESULTS

Baseline Characteristics of the Physician Sample

Intervention and control physician groups did not differ with regard to the distribution of faculty physicians (27.4% in the intervention group vs 32.3% in the control group, $P = .27$), female sex (40.1% vs 41.2%, $P = .59$), or mean number of scheduled visits per week.

Resource Use

One thousand thirty-eight patients registered on the Web site and sent 2238 messages (41.8% of patients sent no messages, 19.4% sent one, 16.3% sent 2-3, and 22.5% sent ≥ 4 messages). The growth of patient registration and messaging was uniform during the study period. About half of the messages were related to health-related follow-up, inquiries, or requests for test results. Approximately 20% were appointment related, 15% were referral requests, and 12% were prescription requests or renewals.

Table 1 gives Web, e-mail, and telephone volume for 5 one-week data collection periods during the study among the intervention and control group physicians. The trend in Web message use (the mean number of weekly Web messages per 100 scheduled visits) was modest, approaching that of e-mail use for the intervention physician group. E-mail and telephone volume trends (the mean number of weekly messages reported in the prior week per 100 scheduled visits) were similar between study groups (Wald test, 8.1; $P = .09$ for e-mail; and Wald test, 9.1; $P = .18$ for telephone; controlling for physician type and clinic).

Physician Survey

The response rate to the survey was 71.2% (37 faculty physicians and 57 residents). **Table 2** gives perceived benefits of Web communication with patients. Intervention physicians perceived greater benefits of Web communication than control physicians across all items. For example, intervention physicians were more likely than control physicians to believe that Web communication would be "a good way for patients to contact me" (56.3% vs 41.3%, $P = .04$). The mean score for the Web benefits scale was 4.0 in the intervention group vs 1.1 in the control group ($P = .008$, controlling for physician type and clinic).

Figure 1 shows physician preferences for different modes of communication by health issue. Physicians tended to prefer face-to-face visits as health issues increased in complexity or sensitivity. For example, preference for visits was low for simpler issues such as a cholesterol test results and normal Pap smear or prostate-specific antigen test results (11.7% and 12.7%, respectively) compared with more complex issues such as back pain (50.2%) or more sensitive issues such as prolonged sadness or anxiety (84.7%). By contrast, online messaging decreased markedly relative to other modes as issues became more complex and sensitive. Preference for telephone communication was highest for issues that were moderately complex (such as back pain and abnormal Pap

Table 1. Message Volume by Physician Study Group*

Period [†]	Intervention (n = 65)			Control (n = 67)	
	Web	E-mail	Telephone	E-mail	Telephone
1	4.0	11.5	71.2	10.2	80.5
2	7.2	13.7	74.6	10.4	87.8
3	7.4	11.3	79.8	12.5	81.7
4	8.5	12.8	81.6	11.2	84.5
5	6.9	13.7	63.7	12.2	70.6

*Data are given as mean number of weekly patient messages per 100 scheduled visits.

[†]One-week data collection periods across the 40-week duration of the study.

smear or prostate-specific antigen test results), but was lower for simple issues (such as cholesterol test results) or the most complex and sensitive issues (such as breast or testicular pain and prolonged sadness or anxiety). Physicians in the intervention group endorsed online messaging with patients at higher rates than control physicians only for the less complex or sensitive issues, including normal test results and symptoms such as sore throat or back pain (data not shown).

Physician satisfaction with communication with patients and staff was similar among intervention and control physicians. More than three quarters of all physicians were satisfied with their communication and relationship with patients, as well as communication with staff. However, fewer physicians in both groups were satisfied with patient communication outside of clinic visits (41.7% in the intervention group vs 47.9% in the control group, $P = .35$). General communication scale scores did not differ between the 2 groups (mean score, 1.6 in the intervention group vs 1.9 in the control group; $P = .58$).

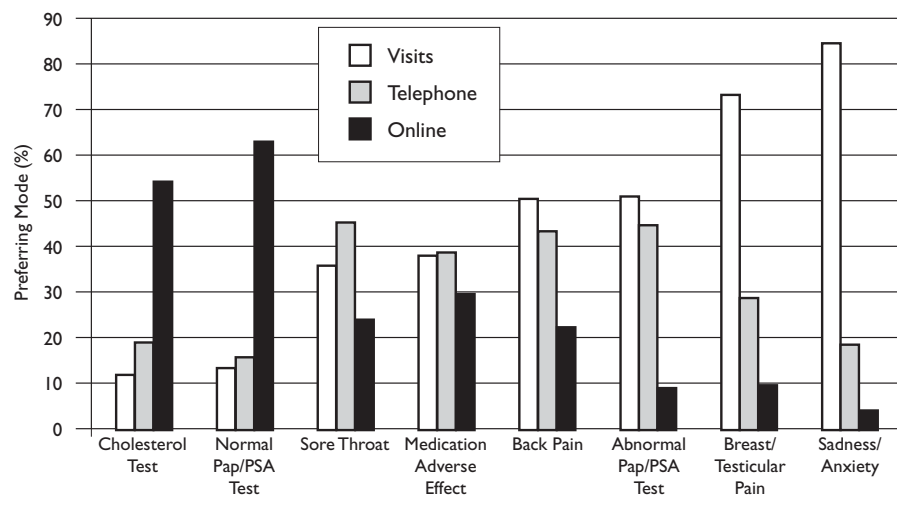
Table 2. Physicians' Web Benefits Scale*

4-Item Scale ($\alpha = .88$)	Intervention	Control	P
	(n = 48) [†]	(n = 46) [†]	
Would encourage my patients to use Web	63.4	39.2	.06
Would be a good way for patients to contact me	56.3	41.3	.04
Would be a good way to follow-up after an appointment	77.1	52.2	.01
Would like to use Web to communicate with patients	62.3	39.4	.03

*Unless otherwise indicates, data are given as percentage of physicians who agree or strongly agree on a 5-point Likert scale.

[†]Ns represent number who completed all items in the scale.

Figure 1. Physician Preferences (n = 94) for Mode of Communication for Selected Health Issues



PSA indicates prostate-specific antigen.

Patient Survey

The overall patient survey response rate was 62.5% (531/850). The mean age was 49.8 years, two thirds were female, and 16.5% were nonwhite. There were no significant differences between respondents and nonrespondents. Only 16.2% had a high school education or less, 30.2% had some college, and nearly one half had a college degree or higher. (Percentages do not total 100% due to missing responses.) Two thirds reported using e-mail at least daily. About 80% of patients reported regular Web use, but only half reported using the Web to shop for items or to bank online.

Attitudes toward electronic communication were somewhat more favorable for intervention vs control group patients, but differences were small. For example, 61.9% of intervention patients vs 54.2% of control patients agreed or strongly agreed that they would like using the Web to communicate with providers ($P = .15$). Differences in Web benefits scale scores were small (2.5 in the intervention group vs 2.1 in the control group, $P = .39$). **Figure 2** shows differences in patient preferences for various modes of communication about selected health topics. Some percentages within health topics sum to more than 100% because respondents could endorse more than 1 mode. The pattern of patient preferences for visits was similar to that of the physicians. Patients preferred visits for more complex or sensitive issues and preferred online communication for less complex or sensitive issues. However, compared with their physicians, the proportion of patients who endorsed online communication was greater across all health topics. There were no significant between-study

group differences in these measures.

The role of clinic staff in electronic communication is one area in which patients and physicians do not agree: 43.5% of patients disagreed that "it is OK for staff to handle my e-mail messages" vs 13.7% of physicians ($P < .01$). The results for Web messaging were similar: 33.5% of patients disagreed that "it is OK for staff to handle my Web messages" vs 11.7% of physicians ($P < .01$). These figures did not differ significantly between study groups. Only 44.4% of study group patients and 47.4% of control group patients agreed that they have

sufficient access to physicians or clinic staff outside of visits. General communication scale scores were similar between groups (1.5 in the intervention group vs 1.2 in the control group, $P = .34$).

DISCUSSION

We performed a randomized controlled trial of a Web-based patient-provider communication tool to evaluate its effect on other modes of communication and patient and provider satisfaction. We found that the Web-based tool increased online communication volume, but only modestly. At its peak, Web communication volume approached that of personal physician e-mail, but it was far lower than telephone volume. Results suggested that only about 10% of patients who were regular users of the Internet registered on our online system during the study period. Personal patient e-mail volume and telephone volume were similar for the study groups. Therefore, the Web messaging did not appear to offset e-mail and telephone volume.

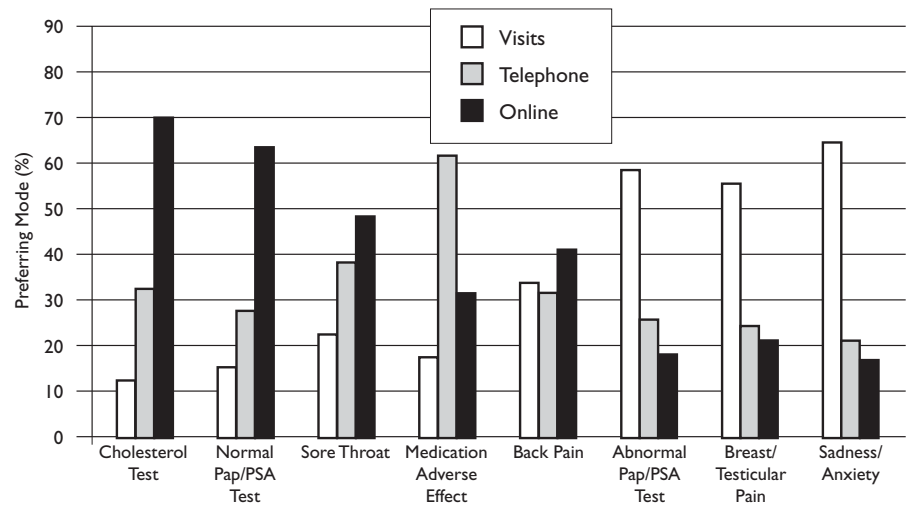
The lower-than-expected amount of Web messaging reflected several factors relevant to a start-up phase of online communication in clinical practice. First, we found that many patients did not have sufficient Web-based experience to navigate the intervention Web site. National surveys show that many adults are not regular Web users, and there are large age, education, and ethnic disparities in use patterns.^{16,17} The report by Houston et al¹¹ in this issue of the *Journal* showed that, even among adults who sought healthcare information on the Internet, fewer than one fifth reported e-mailing their

physician, and there were significant education and ethnicity gradients in use patterns. Second, the Web interface was aimed at clinic staff, as we could not connect physicians directly. Some patients may have resisted using the Web tool, because many patients indicated that they did not favor staff as intermediaries in online communication with their physicians. Finally, patient and staff feedback suggested that the features of the Web interface we developed had some limitations that may have reduced its appeal over regular e-mail and telephone.

Our intervention positively influenced physicians' attitudes toward online communication. Intervention physicians reported perceiving greater benefits of Web use with patients, especially for simpler issues and requests such as normal laboratory results. This suggests that Web-based communication systems can be deployed in a way that improves physician and staff attitudes toward this mode of communication. Yet, physicians' attitudes toward general communication with patients and staff did not appear to be affected by our intervention. In particular, many physicians reported being dissatisfied with the quality of communication with patients outside of visits—the type of communication that may be most subject to improvement via electronic interventions. This may reflect the fact that the telephone remains the primary mode of communication between visits, especially for patients requiring the most between-visit contact. The intervention did not affect patient attitudes toward communication in general, and patients reported dissatisfaction with between-visit communication with their providers.

Our results suggest that patients and physicians differ in their preferences regarding modes of communication. Physicians appeared to “titrate” their preferences for mode based on the complexity and sensitivity of the issues. Physicians favored visits for the most complex or sensitive health issues, while favoring online communication for simple requests. Physician preferences for telephone communication appeared to bridge these other 2 modes of communication, as physicians' telephone communication preferences were highest for health issues that were neither too simple nor too complex or sensitive. Compared with physicians, patients

Figure 2. Patient Preferences (n = 531) for Mode of Communication for Selected Health Issues



PSA indicates prostate-specific antigen.

generally favored online communication over visits even for more complex or sensitive health issues. This likely reflects the increasing desire to avoid the hassles and costs of visits and telephone calls using technology that has now become a common mode for many people. It also may reflect what Houston et al¹¹ found—that electronic communication emboldens patients to ask questions they might not feel comfortable asking in person or on the telephone.

There were also important differences between physicians and patients with regard to preferences for the organization of online communication, as physicians favored a role for intermediary “triage staff,” while patients did not. Patients' expectations and desires for a “direct connect” to their physicians appeared to be greater for e-mail than for the Internet. This may reflect patients' general experiences with these modes of communication, as e-mail is used to communicate directly with 1 or more individuals, while Web communication is used to surf for information or perform services, which are not generally aimed at a specific individual or group of individuals.¹⁸

Staff involved with responding to messages on the Web system (mostly nurses) generally reported favorable attitudes toward online communication (data not shown) and were comfortable responding to online messages. They agreed that the Web messaging system was a good way to communicate with patients, but thought that it added to the daily workload. In general, they were satisfied with getting online with patients and voiced frustration with other modes of communication such as the telephone.

Limitations

Several limitations of this study deserve comment. First, university-affiliated primary care clinics were used; therefore, results may not be generalizable to other settings. Second, limitations of the technology did not allow us to connect physicians to the Web tool. Patient demand for online communication and the content of the interactions may be different if physicians and staff are connected. Third, modest patient use of the Web interface limited power to detect intervention effects on e-mail and telephone volume and visit distribution. Post hoc power calculations showed that the study had 80% power to detect a difference of 12 weekly telephone calls per 100 scheduled visits (52 vs 64) and an absolute difference of 5% in no-show rates (7% vs 12%). Fourth, we did not measure factors that may affect resource use such as work flow associated with different modes of communication. Finally, "contamination" among patients of control physicians may have occurred through promotion of the intervention within clinics used by patients of intervention and control physicians. However, control patients could not access the intervention Web site, and e-mail use among control physicians remained low throughout the study period, suggesting contamination was not an issue.

Implications for Further Research

Many patients and providers are dissatisfied with non-visit-related communication with physicians and their staff. Online communication has the potential to address this unmet need and improve the efficiency and effectiveness of care delivery. Indeed, clinical practices are beginning to make serious investments in online communication. Many providers believe that such investments will pay off quickly by reducing telephone calls and inappropriate visits and by increasing the efficiency of work flow. However, several factors may limit cost savings such as unmet need for communication, insufficient integration, persistent mismatch between communication task and mode, and patient selection factors. One important lesson from our research, which mirrors the experience of others, is the potential for slow uptake of Web messaging during initial phases of deployment. However, advances in technology and increased patient facility with Web-based tools should increase early uptake among patients in new initiatives.

A second lesson from our research is that there is a substantial "digital divide" between patients and their physicians with regard to appropriate content of messaging and the role of staff in the communication flow. This underscores the need for patient and provider promotion strategies.¹⁹ Results from early demonstration

projects suggest that patients will "get the message" and adhere to clinic guidelines about the "dos and don'ts" of online communication.²⁰

Future research should focus on the effect of online communication on quality of care. Although randomization may not be possible in all settings, observational study designs with appropriate control groups may yield valuable information about such outcomes as adherence to preventive care, test result follow-up, medication compliance, and improved self-management of chronic conditions. The prospects for online communication between patients and their providers are bright as improvements in technology fuel strong underlying demand. Appropriate evaluation of online communication will provide the essential information to help advance the use of these new tools in clinical practice and ultimately improve patient care.

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