

Patient Access to an Electronic Health Record With Secure Messaging: Impact on Primary Care Utilization

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Objective: To determine whether patient access to secure patient–physician messaging affects annual adult primary care office visit and documented telephone contact rates.

Study Design: Retrospective cohort and matched-control studies with pre-post analysis.

Methods: The cohort study sample included 4686 adult members of Kaiser Permanente Northwest (KPNW) who had been registered KP HealthConnect™ Online users longer than 13 months and had used at least 1 feature. The matched-control study sample included 3201 randomly selected controls matched by age/sex, selected chronic conditions, and primary care physician to 3201 registered users. We calculated the difference in primary care office visit and documented telephone contact rates in the pre- and post-periods (defined, respectively, as 3-14 months before and 2-13 months after registration for KP HealthConnect™ Online). Paired *t* tests were used to assess significance.

Results: Annual office visit rates decreased by 0.23 (–9.7%) visits per member in the cohort study. Annual office visit rates for users in the matched-control study decreased by 0.25 (–10.3%); the corresponding decrease for the controls was 0.08 (–3.7%). This 0.17 (–6.7%) reduction was significant (*P* < .003). Annual documented telephone contact rates for users in the matched-control design increased by 0.32 (16.2%) contacts per member; the corresponding rate for the control group was 0.52 (29.9%). This 0.20 (13.7%) difference was significant (*P* < .01).

Conclusion: Patient access to the secure messaging feature of KP HealthConnect™ Online was associated with decreased rates of primary care office visits and telephone contacts.

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For author information and disclosures, see end of text.

Widespread efforts to improve healthcare quality, safety, and efficiency focus on using information technologies such as electronic health records, patient registries, computerized physician order entry, embedded decision supports, and others. Among these, electronic patient–physician messaging has been viewed as a promising technology to improve the quality and efficiency of healthcare.¹

Electronic communication between patients and physicians can reduce health plan spending on physician office and laboratory services.² Patients and physicians alike indicate satisfaction with electronic messaging.^{3,4} Ninety percent of US consumers with Internet access indicate a clear preference for online communications with healthcare providers.⁵

Complex issues of reimbursement, confidentiality, and liability have impeded widespread adoption of patient–physician electronic messaging in the United States. However, these issues appear to be resolving. Following the American Medical Association’s 2004 approval of online consultation billing, some US insurers have recently offered reimbursement for its use.^{5,6} Similarly, secure Web messaging represents a security improvement over e-mail, reduces liability,^{7,8} and is increasingly available as a stand-alone service to physicians without electronic health record systems.⁹

Some physicians may be concerned that the use of secure messaging would increase their overall workload.¹⁰ The extent to which secure messaging can substitute for office visits or telephone contacts is unclear. Previous studies offer conflicting evidence: telephone communication is not impacted by electronic messaging,^{11,12} office visits are reduced,^{13,14} and both telephone contacts and office visits are reduced by electronic communication.¹⁵ These studies were small in size and limited in scope; the largest involved roughly 1000 health-related messages.¹²

To investigate the relationship between patient–physician electronic messaging and physician workload, we evaluated the impact of patient access to an electronic health record with secure patient–physician messaging on primary care office visit and documented telephone contact rates in an entire Kaiser Permanente (KP) operating region.

METHODS

Setting

KP is the nation’s largest not-for-profit integrated healthcare delivery

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system with more than 8.5 million members in 8 geographic regions. Professional partnerships in each region employ physicians and contract with the not-for-profit Kaiser Foundation Health Plan to arrange necessary medical care for members.

KP's integrated healthcare delivery system addresses all healthcare needs for adult and pediatric members, including preventive, routine, specialty, emergency, and inpatient care; ancillary testing; pharmacy and rehabilitative services; and home care. The Kaiser Permanente Northwest (KPNW) region, with nearly 487 000 adult and pediatric members in April 2006, is located in Oregon and southwest Washington.

KP HealthConnect™ Online

KP is implementing an integrated electronic health record throughout the entire enterprise.¹⁶ Based on software supplied by Epic Systems, it is known as KP HealthConnect™. Members can access parts of their individual health records through a secure member Web site: www.kp.org. After registering as users, they may take advantage of all KP HealthConnect™ Online features (Table 1). Messaging takes place within a secure Web environment. User accounts are activated by passwords mailed to members' homes, and all messaging takes place in an authenticated/encrypted environment and behind an enterprise-level firewall.

Members are clearly informed that receiving a response to a secure message may take up to 2 business days and that messaging is only appropriate for nonurgent concerns. The member-only Web site, www.kp.org, contains the following warnings on the secure messaging screen: "Do not attempt to access emergency care through this Web site ... call 911 or go to the nearest hospital." "If you have an urgent symptom or want to speak with a nurse, do not use this Web site. Please call your local Kaiser Permanente facility."

KP HealthConnect™ Online was first implemented as a pilot project (Personal Health Link) in November 2002 for adult members in the Northwest region. As of September 2005, 18 094 members were registered users, representing 6% of the total KPNW adult membership.

Design

To evaluate the impact of KP HealthConnect™ Online on primary care office visit and documented telephone contact rates, we conducted a pair of retrospective studies. The 2 designs relied on administrative data about subject characteristics, primary care office visit and telephone contact rates, and KP HealthConnect™ Online use. The use of complementary designs allowed us to examine the impact of secure messaging in 2 ways: in the largest possible sample and while controlling for factors that might impact validity.

Cohort Study. A retrospective cohort study included 4686 adult members who were registered KP HealthConnect™ Online users for longer than 13 months, had used at least 1 feature, and were continuously enrolled as KPNW members during the study period. Cohort subjects must have registered to use KP HealthConnect™ Online by August 2004. For the majority, the study period occurred between September 2002 and August 2005. Cohort subjects were on the patient panels of approximately 250 primary care physicians.

Matched-control Study. A retrospective matched-control study included 3201 subjects who were also part of the cohort described above. For each, we identified and randomly selected control matched by age, sex, selected chronic conditions (eg, diabetes, congestive heart failure), and primary care physician.

For both studies, we defined the pre-period as 3 to 14 months before KP HealthConnect™ Online registration and the post-period as 2 to 13 months afterward. Immediately around the time of registration, outpatient visit rates for subjects in both the cohort and matched-control studies were above baseline levels because many people learned about KP HealthConnect™ Online during clinic visits for active health concerns. To conservatively estimate the impact on utilization of access to KP HealthConnect™ Online, we omitted this spike in outpatient visit and telephone contact rates from our analysis.

Outcome variables included annual adult primary care office visit rates, comprising appointments with physicians and physician extenders (nurse practitioners and physician assistants) in adult primary and urgent care (nonemergency) settings. Documented telephone contact rates included both scheduled telephone visits and unscheduled telephone calls to and from internal medicine and family practice physicians, nurse practitioners, and physician assistants.

Statistical Analysis

We used the χ^2 test to look for differences in age/sex and the prevalence of diabetes and congestive heart failure between 5 groups of interest: the 323 296 adult members of KPNW, 18 094 KPNW members who had registered with KP HealthConnect™ as of September 2005, the 4686 cohort subjects, the 3201 subjects of the matched-control study, and the 3201 controls of the matched-control study.

Differences in office visit and telephone call rates were symmetric about the mean, although not normally distributed based on the formal normality test. However, because percent changes in mean utilization rates are the most operationally meaningful way of examining trends, and parametric tests are

■ **Table 1.** Kaiser Permanente HealthConnect™ Online Features Available During Study Period

Secure provider messaging	Patient–physician Patient–advice nurse Patient–pharmacist
Administrative requests	Update medical record Membership services Appointment Change e-mail address, mailing address, telephone, and password Web site feedback and questions
Health summary	Problem list Medications Allergies
Health records	Immunizations Wallet card
Visit-related inquiries	Recent visits After-visit summary Future appointments Information about obtaining referrals
Member education materials	

than did the general adult membership. Similarly, cohort members were older and included a higher proportion of individuals with diabetes than did the larger user population. The differences in age/sex and the proportion of members with diabetes between the cohort and the general adult membership were significant ($P < .0001$). By design, cohort subjects and both groups in the matched-control study did not differ to a statistically significant degree in terms of age and the proportion of members with diabetes. **Table 2** summarizes these results.

Annual Adult Primary Care Office Visit Rates

Baseline primary care office visit rates for cohort and matched-control subjects were slightly higher than the baseline rates for the entire region, consistent with the increased prevalence of chronic conditions. The baseline visit rate of the control group in the matched-control study was between the regional baseline rate and the subjects' rate.

Cohort Study. Annual adult primary care office visit rates decreased by 9.7%, a statistically significant decline from 2.47 to 2.24 office visits per member per year ($P < .001$).

Matched-control Study. For the subjects in the matched-control study, the annual adult primary care office visit rate decreased by 10.3%, or 0.25 visits per member per year ($P < .001$). The corresponding decrease for controls was 3.7%, or 0.08 visits ($P < .003$). The difference between changes in primary care office visit rates for the 2 groups, 6.7%, was also statistically significant ($P < .003$). **Table 3** summarizes office visit utilization results for both studies.

Primary Care Telephone Contact Rates

KPNW implemented new documentation procedures for telephone contacts during the study period; as a result, documented primary care telephone contact rates for the entire region increased by 24%. Documented primary care telephone rates for the cohort subjects increased by 15.6%.

To evaluate the impact of access to KP HealthConnect™ Online in the context of this broad trend, we relied on the matched-control study.

Matched-control Study. The annual primary care telephone contact rate for subjects increased by 16.2%, or 0.32

robust to deviations from Gaussian distributions when samples are large,¹⁷ we used the paired t test to assess the statistical significance of differences in utilization rates over time and across groups. As a matter of interest, the Wilcoxon rank sum test and the paired t test yielded identical statistical significance.

Cohort Study. We calculated the difference in primary care office visit and documented telephone contact rates between the pre- and post-periods, assessing statistical significance with the paired t test.

Matched-control Study. We calculated the difference in primary care office visit and documented telephone contact rates in the pre- and post-periods for subjects and for controls, again assessing statistical significance with the paired t test. In addition, we also used the paired t test to assess the statistical significance of the variation in rate changes between the subject and control groups.

RESULTS

In general, KP HealthConnect™ Online users were older and included a higher proportion of members with diabetes

■ **Table 2.** Characteristics of Kaiser Permanente Northwest Membership, Kaiser Permanente HealthConnect™ Online Users, and Study Subjects

Characteristic	Percentage				
	Adult Members (n = 323 296)	Member Users* (n = 18 094)	Cohort Subjects* ^{†,‡} (n = 4686)	Matched- control Subjects* ^{†,‡} (n = 3201)	Matched Controls* ^{†,‡} (n = 3201)
Sex/Age[§]					
Female					
18-24 y	5.1	2.5	1.3	0.9	0.9
25-34 y	8.7	7.4	5.2	4.6	4.6
35-44 y	10.1	10.2	8.4	8.5	8.5
45-54 y	11.9	16.6	15.8	15.6	15.6
55-64 y	8.6	14.5	15.8	16.3	16.3
65+ y	8.6	7.8	9.9	10.7	10.7
Male					
18-24 y	4.5	0.8	0.6	0.3	0.3
25-34 y	7.8	3.2	2.5	2.1	2.1
35-44 y	9.4	5.6	4.9	4.4	4.4
45-54 y	10.6	10.9	10.7	10.5	10.5
55-64 y	8.1	12.1	13.4	14.1	14.1
65+ y	6.6	8.5	11.5	12.1	12.1
All	100	100	100	100	100
Prevalence of Chronic Conditions					
Type 2 diabetes	8.9	13.5	14.8	14.9	14.9
Congestive heart failure	3.2	3.9	4.2	3.7	3.7
<p>*Group age/sex composition and prevalence of chronic conditions differ from those of all Kaiser Permanente Northwest adult members to a statistically significant degree ($P < .0001$). However, there is no statistically significant difference in prevalence of congestive heart failure between the matched-control subjects and controls and the Kaiser Permanente Northwest adult membership.</p> <p>[†]Group age/sex composition and prevalence of diabetes differ from those of all Kaiser Permanente Northwest HealthConnect™ member users to a statistically significant degree ($P < .05$). The between-group differences in the prevalence of congestive heart failure are not statistically significant.</p> <p>[‡]No statistically significant differences in group age/sex composition and prevalence of chronic conditions were found between cohort subjects, matched-control subjects, and matched controls.</p> <p>[§]For adult members, age and sex were determined as of September 2005; for member users, cohort subjects, and matched-control subjects, at registration; and for matched controls, at registration of matched-control subjects.</p>					

documented telephone contacts per member per year, over the study period ($P < .001$). The corresponding increase for controls was 29.9%, or 0.52 documented telephone contacts per member per year ($P < .001$). The difference between these increases (13.7%) was also statistically significant ($P < .01$), as displayed in **Table 4**.

DISCUSSION

We evaluated the impact on office visit and telephone contact rates of patient access to an integrated multifunction electronic personal health record that included secure

patient–physician electronic messaging. Annual adult primary care outpatient visit rates decreased by 6.7% to 9.7% for members using KP HealthConnect™ Online, and these members had a smaller increase in documented telephone contacts (16.2%) than the control group (29.9%).

Conducting a randomized controlled trial would have required fundamental changes to the KP HealthConnect™ system so that only patients randomized to the intervention were allowed to access online features. However, inconsistent member access to system features would have resulted in a prohibitive work-flow burden for physicians and healthcare teams. Additionally, random implementation of secure messaging

■ **Table 3.** Impact of Kaiser Permanente HealthConnect™ Online on Annual Adult Primary Care Office Visit Rates

Annual Adult Primary Care Office Visit Rates per Member						
	Matched-control Design					
	Cohort Design (n = 4686)		Subjects (n = 3201)		Matched Controls (n = 3201)	
	Mean	95% CI	Mean	95% CI	Mean	95% CI
Preregistration	2.47	2.44, 2.50	2.44	2.35, 3.54	2.15	2.08, 2.23
Postregistration	2.24	2.17, 2.31	2.19	2.11, 2.27	2.07	2.00, 2.15
Within-group change	-0.23*	-0.31, -0.17	-0.25*	-0.33, -0.17	-0.08†	-0.16, -0.01
Across-group difference						-0.17*
Within-group change	-9.7%		-10.3%		-3.7%	
Across-group difference						6.7%†

*P < .001.
†P < .003.
CI indicates confidence interval.

■ **Table 4.** Impact of Kaiser Permanente HealthConnect™ Online on Annual Primary Care Telephone Contact Rates

Annual Adult Primary Care Documented Telephone Contact Rates per Member: Matched-control Design				
	Subjects (n = 3201)		Matched Controls (n = 3201)	
	Mean	95% CI	Mean	95% CI
Preregistration	2.00	1.89, 2.11	1.74	1.63, 1.85
Postregistration	2.32	2.21, 2.43	2.26	2.14, 2.37
Within-group change	0.32*	0.22, 0.43	0.52*	0.41, 0.63
Across-group difference	0.20*			
Within-group change	16.2%		29.9%	
Across-group difference	13.7%†			

*P < .001.
†P < .01.
CI indicates confidence interval.

Online use among 1000 registered users found that more than 70% of sessions resulted in patient–physician messaging, indicating the importance and influence of this feature.

Although our sample size didn't support evaluating the impact of individual features, registered users most frequently cited telephone calls and office visits as alternatives to secure messaging. A random sample of 2700 KP HealthConnect™ Online users who e-mailed their physicians during a 3-month period yielded more than 1700 completed questionnaires. A quarter of the respondents indicated

would have confounded its true operational impact on office visit utilization. Nevertheless, our study controlled for individual patient factors, physician work styles, and regional trends as alternative explanations for reduced utilization.

Access to parts of the personal health record or other KP HealthConnect™ Online features may have influenced primary care office visit and documented telephone contact rates. However, an early evaluation of KP HealthConnect™

they would have scheduled an appointment in lieu of electronic messaging (Figure) and were satisfied with and appreciated the alternative mode of care.

A limitation of our study is that the subjects and controls in the matched-control study were not paired by baseline office visit or telephone contact rates. Subjects had higher preregistration utilization rates than did controls because high utilizers were more likely to register. Further research would

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assess whether different baseline utilization rates affect the impact of access to secure messaging on utilization rates.

Our study suggests several additional areas for further study. Annual primary care office visit rates held steady for the region as a whole. However, visit rates were lower, to a statistically significant degree, in the post-period for both groups in the matched-control study. We hypothesize that, because subjects and controls were matched by primary care physician (among other characteristics), these physicians may have become more attuned to care efficiencies during the study period. Further research would validate this hypothesis.

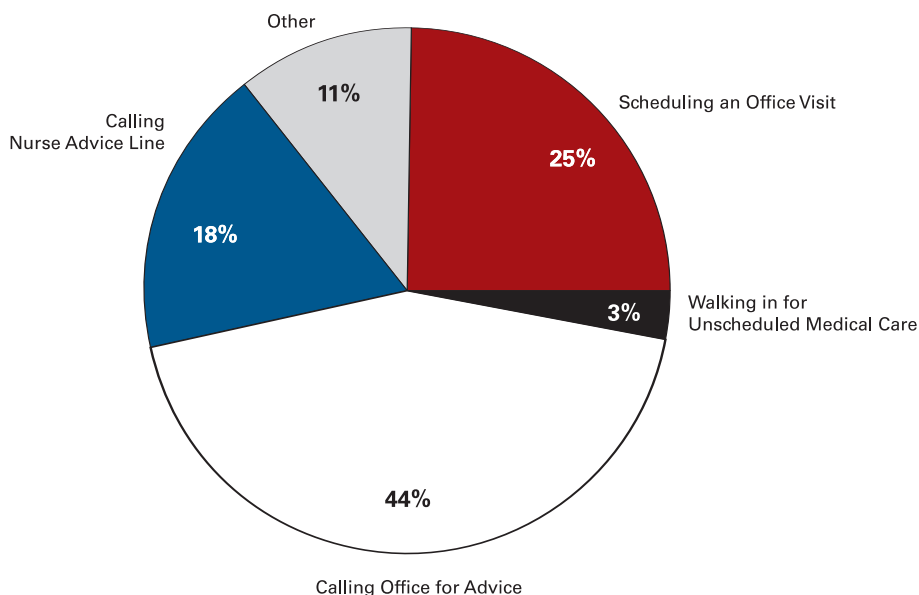
Members with diabetes were disproportionately represented among KP HealthConnect™ Online users. This fact raises important questions about electronic communications in chronic illness care. Other models of electronic communications, such as Internet-based glucose self-monitoring programs, have proved effective in increasing glucose control over the short term,¹⁸ and physicians view electronic communication as enhancing care for patients with chronic conditions.¹⁹

Anecdotal evidence from KP physicians indicates that secure messaging may actually increase the number of patient “touches.” In addition to messaging itself, in 19.4% of 93 randomly sampled patient–physician secure message threads, the physician recommended an additional contact: a laboratory test, phone call, office visit, procedure, or health education class. It is important to note that some key elements of diabetes clinical treatment guidelines (ie, glycated hemoglobin [HbA1C], lipid, and microalbuminuria monitoring) do not require a face-to-face physician office visit with the availability of an electronic medical record.

To confirm that secure messaging is used for nonurgent issues, a review of the level of service of 50 secure messaging threads revealed that two thirds were coded as either “brief” or lower.

KPNW collects data for the Health Employer Data and Information Set (HEDIS®) as part of routine quality surveillance. The HEDIS reports for HbA1c testing did not vary

■ **Figure.** Preferred Alternatives to Electronic Patient–Physician Messaging According to Surveyed Kaiser Permanente HealthConnect™ Online Users



Source: Kaiser Permanente Program Office National Market Research, 2005.

to a statistically significant degree during the years under observation.

Secure messaging reduces overall physician workload if it requires less time than the replaced visits and telephone contacts. Although we did not examine overall efficiency, patients perceive electronic messaging as preferable to telephone consultations in many situations.²⁰ Physicians and staff state that electronic messaging requires less time than telephone calls and that lengthy messages can be completed at intervals throughout the day.²¹

The extra capacity that secure messaging creates through increased efficiency can be used at the discretion of the care provider or organization. In noncapitated systems, an overall reduction in office visit rates may not be financially advantageous, and providers may choose to fill the resulting extra capacity with additional patient visits with a higher level of service to recover lost revenue. In a system with different incentives, more preventive care could take place at each visit or the time freed up by reduced office visit rates could be used for panel management.

KP is a largely prepaid, integrated healthcare delivery system. Patients and physicians generally used electronic messaging free of the reimbursement concerns that presently challenge the US healthcare system. The results from this large-scale study of secure messaging indicate that, as these issues resolve, it may provide a win-win-win solution to perva-

Take-away Points

This is the largest study to date of the impact of access to secure patient-physician messaging on provider workload. The results demonstrated that:

- Annual adult primary care outpatient visits decreased by 6.7% to 9.7% among patients using electronic messaging.
- Members using electronic messaging had a smaller increase in documented telephone contacts (16.2%) than the control group (29.9%).
- Electronic messaging may provide a solution to pervasive efficiency and access issues for both patients and providers.

sive efficiency and access issues from the perspectives of patient, healthcare provider, and payer.

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