CIN: Computers, Informatics, Nursing • Vol. 29, No. 12, 714–718 • Copyright © 2011 Wolters Kluwer Health | Lippincott Williams & Wilkins

CONTINUING EDUCATION

Patient-Provider Internet Portals—Patient Outcomes and Use

RYAN J. SHAW, MS, RN
JEFFREY FERRANTI, MD, MS

An important emerging information technology tool is the electronic health record with a patient-provider Internet portal. Patient-provider Internet portals offer a venue for providing patient access to personal health data. In this study, we conducted a cross-sectional secondary data analysis to describe the types of diabetes patients who utilize the patient-provider Internet portal and examine any preliminary differences in patient outcomes. Data from this study suggest that a significant portion of patients (29.7%) with diabetes utilize the portal. Clinical outcome results indicated that portal use was not a significant predictor of low-density lipoprotein and total cholesterol levels. However, portal use was a statistically significant predictor of glycosylated hemoglobin (HbA_{1c}) ($P < .001$). As patient-provider Internet portals are increasingly implemented and utilized across the nation, both clinical and nonclinical impacts must be evaluated. Patient-provider Internet portals have the ability to provide patients with the opportunity to be increasingly involved in their own care, enhance patient-provider communication, and potentially reduce inequity, improve clinical outcomes, and increase access to care.

KEY WORDS

Clinical informatics • Diabetes • Patient portal

The Institute of Medicine and the Office of the National Coordinator for Health Information Technology have identified the adoption of information technology (IT) as a crucial factor in improving the nation's health system.[1,2] An important emerging IT tool is the electronic health record with a patient-provider Internet portal. This technology will move the United States toward a more patient-centered healthcare system and will promote more active collaboration between providers and patients.

Patient-provider Internet portals offer a venue for providing patient access to personal health data. A patient-provider Internet portal is an Internet-based interactive Web site for patients to communicate with their healthcare providers and include varied functions that give them access to portions of their medical records and provide other services.[3] These features and functions can include personal and medical history, immunization lists, medication lists, test results, allergy lists, health reminders, health assessment and self-management tools, personalized patient education materials, hyperlinks to additional health information on the Web, the ability to report home tests or results of medical monitors, the ability to make appointments, asynchronous communication between patient and provider, paperwork completion, billing, and personal information updates.

Research on patient-provider Internet portals demonstrates increased satisfaction with overall care,[4] improved patient-provider communication,[5] enhanced safety,[6–8] improved screening of chronic conditions,[9] and potentially reduced costs. Patient access to personal data is associated with enhanced physician-patient communication,[10] greater patient empowerment,[10] more effective patient care,[11] better adherence to health promotion recommendations,[12] and overall improvement in health outcomes.[13] Patients believe that compliance with treatment regimens may improve with access to laboratory and chart records that are presented in a clear graphical manner.[14] Patient access to personal medical

Author Affiliations: Duke University School of Nursing (Mr Shaw), Duke Health Technology Solutions (Mr Shaw and Dr Ferranti), and Duke University School of Medicine (Dr Ferranti), Durham, NC.

The authors have disclosed that they have no significant relationship with, or financial interest in, any commercial companies pertaining to this article.

Corresponding author: Ryan J. Shaw, MS, RN, Duke University School of Nursing, DUMC 3322 307 Trent Dr, 3080, Durham, NC 27710 (ryan.shaw@duke.edu).

DOI: 10.1097/NCN.0b013e318224b597

data may also act as an adjunctive therapeutic intervention, increasing self-reported satisfaction,[15] enhancing comfort,[16] and significantly improving self-reported health status and self-assessed physical functioning in patients with chronic disease.[17,18] Providing health information electronically and allowing patients to review medical records and prescriptions enhance safety and address quality issues,[19,6,7] acting as another level of security in the elimination of preventable errors.

Portal creation is driven by a trend[20,21] toward patients becoming participating members of the healthcare team rather than passive recipients of care.[22,23] There are several factors driving this change: the need to deliver timely, quality care in a cost-effective manner; the need to enhance patient safety; personal motivation of patients and consumers to become empowered; and the advent of the Internet as a healthcare medium.

An active and involved patient is more likely to manage chronic conditions effectively.[9,24] Thanks in part to the pervasiveness of the Internet and the availability of health information, patients are increasingly motivated to become involved in their own healthcare and in health information gathering. Thus, the Internet serves as a mechanism of empowerment.[25,26] It brings the ability to conduct in-depth information searches to the general population, can assist health consumers in deciding about treatment and in determining when to see a provider, and helps prepare them to actively participate in their care.[27] Searching for health information is the third most popular use of Internet technology.[28] It is estimated in the United States that health information is sought online by 81% of Internet users and 66% of all adults.[29] Additionally, people who feel they have a lot at stake, particularly those with disability or chronic illness, are more likely to engage intensely with online resources.[30]

Thus, we hypothesize that patients, particularly those with chronic illness, who engage with a patient-provider Internet portal may have improved clinical outcomes due to the ability to be more engaged with their own healthcare. However, limited research exists describing whether users of patient-provider Internet portals differ from nonusers, or if there is a significant difference in clinical outcomes.

In this study, we conducted a cross-sectional secondary data analysis to describe the types of diabetes patients who utilize the patient-provider Internet portal and explore any preliminary differences in patient outcomes. We examined whether patients with diabetes who are users of the patient-provider Internet portal had a significant difference in clinical indicators compared with diabetes patients who are nonusers. Additionally, we examined the relationship between the number of portal log-ins and clinical indicators to explore whether increased use of the portal was associated with a difference in clinical outcomes.

Health View

Formally known as "Health View," the patient-provider Internet portal serves as a venue for patients to connect to their medical and financial information and to view and request provider appointments. Current system capabilities include billing and payments, request and view future appointments, e-mail appointment reminders, view and change demographic and financial information, view laboratory data, radiology results, allergies and discharge instructions, and rapid check-in.

METHODS

Data were acquired from the Duke University Medical Center data warehouse through the Duke Enterprise Data Unified Content Explore (DEDUCE), an online research tool that provides investigators with access to clinical information collected as a by-product of patient care. DEDUCE compiles data from multiple source systems and allows researchers to define a clinical cohort and streamline electronic chart review. Institutional review board approval was obtained through the Duke University Medical Center Institutional Review Board.

Data were interrogated by an independent data technician and delivered to the researchers free of personal health information. At time of interrogation (November 2009), all patients in this sample with a diagnosis of either type 1 or type 2 diabetes and who were enrolled in a provider-centered decision support tool were included. The decision support tool delivers clinical practice recommendations to clinicians through an electronic health record, thus making it more likely that patients receive similar care across providers and decreased variability in delivery of care. Demographic and laboratory data were mined. Demographic data included sex, age, and race. Laboratory data included the last glycosylated hemoglobin (HbA_{1c}) level, low-density lipoprotein (LDL) level, and total cholesterol levels. Other tracking data included flag for patient-provider portal user, flag for type 1 or type 2 diabetes, last recorded weight, and number of portal log-ins over the past 4 months.

Data Analysis

Descriptive statistics, Student *t* test, and simple linear regression were utilized using the JMP statistical software package (SAS Institute, Cary, NC).

RESULTS

Mean ages for portal users (n = 5963) were 52 (SD, 1.4) years with a range of 10 to 99 years and 57 (SD, 1.6)

Table 1

Portal Users and Non–Portal Users by Race

	Portal User		
Race	Yes	No	Total
White	4101 (38%)	6792 (62%)	10 893 (55.1%)
Black	1542 (19%)	6580 (81%)	8122 (41.1%)
Asian	127 (49%)	135 (51%)	262 (1.3%)
Native American	13 (24%)	41 (76%)	44 (.2%)
Other	120 (27%)	326 (73%)	446 (2.3%)
Total	5903 (29.9%)	13 874 (70.1%)	19 767

years with a range of 10 to 99 years for non–portal users (n = 13 702). Descriptive statistics are summarized in Tables 1 to 3. Among patients with type 2 diabetes, portal users' (n = 5343) mean HbA_{1c} was 7.19, and among non–portal users (n = 11 363), mean HbA_{1c} was 7.39 ($P < .0001$) (Table 4). Among patients flagged as having type 1 diabetes, mean HbA_{1c} was 7.89 for portal users (n = 1134) and 8.16 for non–portal users (n = 2190, $P < .0001$). Mean weights were 211 lb for portal users and 200 lb for non–portal users. Differences in LDL and total cholesterol were nonsignificant between the two groups. The number of portal log-ins was not significantly correlated with HbA_{1c}, LDL, or total cholesterol.

DISCUSSION

With more than 100 000 patients overall and 6000 with a diagnosis of diabetes alone currently using our patient-provider Internet portal, this platform has the potential to serve as an important venue to deliver nursing, medical, and public health interventions and care. Data from this study suggest that a significant portion of patients (29.7%) with diabetes utilize the portal. Thus, patient-provider Internet portals may serve as an appropriate venue to deliver diabetes care, education, and support.

Clinical outcome results indicated that portal use was not a significant predictor of LDL and total cholesterol levels. Portal use was a statistically significant predictor of HbA_{1c} ($P < .0001$); however, with an HbA_{1c} difference of 0.2 for patients with type 2 diabetes and 0.25 for patients with type 1 diabetes, clinical significance is debatable. These results suggest that something may be occurring between portal users and non–portal users. Whether a difference in HbA_{1c} between the two groups is due to influences of the portal itself or a difference in the characteristics of people who tend to use portals cannot be determined from this study. Further research is warranted.

Table 2

Portal Users and Non–Portal Users by Sex

	Portal User		
Sex	No	Yes	Total
Female	7889 (70.9%)	3239 (29.2%)	11 128 (55.6%)
Male	6196 (69.6%)	2698 (30.4%)	8894 (44.4%)
Total	14 085 (70.3%)	5937 (29.7%)	20 022

Table 3

Portal Users by Age (n = 20 022)

	Portal User		
Age, y	Yes	No	Total
10–19	91 (32%)	197 (68%)	288 (1.4%)
20–29	107 (33%)	215 (67%)	322 (1.6%)
30–39	425 (40%)	646 (60%)	1071 (5.4%)
40–49	962 (36%)	1678 (64%)	2640 (13.2%)
50–59	1779 (37%)	3015 (63%)	4794 (23.9%)
60–69	1663 (31%)	3634 (69%)	5297 (26.5%)
70+	924 (16%)	4686 (84%)	5610 (28%)
Total	5951	14 071	20 022

Diverse Populations

Overall, diabetes portal users tend to be younger, female, and nonblack. The portal may serve as a valuable setting to reach diverse populations. Approximately 45% of portal users are nonwhite, and more than 30% of patients with diabetes between the ages of 10 and 69 years utilize the portal.

Diabetes Care, Education, and Support

Online social networking, group chat features, and video conferencing are not currently available through our portal. However, such interactive features may have positive benefits when implemented. Potential advantages of integrating these features with the portal include a secure chat feature between patient and provider that could serve as a venue to increase reach and access to care. Actual visits could be made between patient and provider

Table 4

Mean HbA_{1c} Levels

	Type 1 Diabetes	Type 2 Diabetes
Portal user (n = 6477)	7.89[a] (n = 1134)	7.19[a] (n = 5343)
Non–portal user (n = 13 553)	8.16[a] (n = 2190)	7.39[a] (n = 11 363)

[a] $P < .0001$.

via the portal using synchronous chat or through face-to-face video conferencing. This could reduce costs for both patient and provider, increase access to care, and cut down the amount of time and travel required of the patient, especially those who live far from their provider or have difficulty getting access to transportation. Overhead expenses for the provider could potentially be reduced in some clinical settings. An RN or other provider could deliver diabetes education to patients who may not otherwise be able to travel to a formal diabetes education class. Imagine a patient speaking to the provider in a window in the portal, while a graph of laboratory value trends are displayed adjacent. Blood pressure, heart rate, and blood glucose check monitoring occur simultaneously through home self-monitoring devices and uploaded directly into the portal. While this is happening, the provider is able to visually inspect the patient. Additionally, online social networking through the portal could serve as a secure venue for patients to communicate with each other, creating a social support network. Providers could also be integrated into these online social support networks.

Limitations

Several limitations exist to this study. This study used a one-time view of portal use and clinical indicators. Thus, we were unable to draw conclusions as to the effect of the portal on patient outcomes. Socioeconomic and education data were not available. Because of the design, it is difficult to understand whether portal users tend to be of higher socioeconomic or education status.

Future Research

Results from this study suggest that more rigorous examinations of the impact of patient-provider Internet portals are warranted. Our next step is to use a longitudinal data analysis examining clinical outcomes before and after use of the portal within and between individual subjects controlling for a number of covariates. This will provide more conclusive results.

Additional health services research (eg, financial, access to care) of the patient-provider Internet portal is needed. A randomized controlled intervention would produce valuable data and increased knowledge of the impact of these portals on both clinical and nonclinical outcomes.

CONCLUSION

As the nation accelerates the implementation of IT systems into the healthcare sector, research is needed to understand the consequences, both positive and negative. It is critical to evaluate new and emerging IT systems to ensure they provide the greatest benefit with the smallest number of adverse consequences. As patient-provider Internet portals are increasingly implemented and utilized across the nation, we need to evaluate both clinical and nonclinical impacts. Through optimization of IT systems, such as patient-provider Internet portals, we can provide patients with the ability to be increasingly involved in their own care, enhance patient-provider communication, and potentially reduce inequity, improve clinical outcomes, and increase access to care.

Acknowledgment

The authors thank Nelda Bradley for her expertise.

REFERENCES

1. Institute of Medicine. *Using Information Technology. Crossing the Quality Chasm: A New Health System for the 21st Century.* Washington, DC: National Academy Press; 2001.
2. Thompson TG, Brailer DJ. *The Decade of Health Information Technology: Delivering Consumer-Centric and Information-Rich Health Care. Framework for Strategic Action.* Washington, DC: Department of Health and Human Services; 2004.
3. Sorensen L, Shaw R, Casey E. Patient portals: survey of nursing informaticists. *Stud Health Technol Inform.* 2009;146:160–165.
4. Lin CT, Wittevrongel L, Moore L, Beaty BL, Ross SE. An Internet-based patient-provider communication system: randomized controlled trial. *J Med Internet Res.* 2005;7(4):e47.
5. Allen M, Iezzoni LI, Huang A, Huang L, Leveille SG. Improving patient-clinician communication about chronic conditions: description of an Internet-based nurse E-coach intervention. *Nurs Res.* 2008;57(2):107–112.
6. Weingart SN, Hamrick HE, Tutkus S, et al. Medication safety messages for patients via the Web portal: the MedCheck intervention. *Int J Med Inform.* 2008;77(3):161–168.
7. Schnipper JL, Gandhi TK, Wald JS, et al. Design and implementation of a Web-based patient portal linked to an electronic health record designed to improve medication safety: the Patient Gateway medications module. *Inform Prim Care.* 2008;16(2):147–155.
8. Siteman E, Businger A, Gandhi T, et al. Clinicians recognize value of patient review of their electronic health record data. *AMIA Annu Symp Proc.* 2006:1101.
9. Leveille SG, Huang A, Tsai SB, Weingart SN, Iezzoni LI. Screening for chronic conditions using a patient Internet portal: recruitment for an Internet-based primary care intervention. *J Gen Intern Med.* 2008;23(4):472–475.
10. Ross SE, Lin CT. The effects of promoting patient access to medical records: a review. *J Am Med Inform Assoc.* 2003;10(2):129–138.
11. Cohen RN. Whose file is it anyway? Discussion paper. *J R Soc Med.* 1985;78(2):126–128.
12. Bronson DL, O'Meara K. The impact of shared medical records on smoking awareness and behavior in ambulatory care. *J Gen Intern Med.* 1986;1(1):34–37.
13. Jamison HB, Sher PP. Consumer health informatics: health information technology for consumer. *J Am Soc Inf Sci.* 1995;46:783–790.
14. Bronson DL, Rubin AS, Tufo HM. Patient education through record sharing. *QRB Qual Rev Bull.* 1978;4(12):2–4.
15. Bird AP, Walji MT. Our patients have access to their medical records. *Br Med J (Clin Res Ed).* 1986;292(6520):595–596.
16. Fisher B, Britten N. Patient access to records: expectations of hospital doctors and experiences of cancer patients. *Br J Gen Pract.* 1993;43(367):52–56.

17. Maly RC, Bourque LB, Engelhardt RF. A randomized controlled trial of facilitating information giving to patients with chronic medical conditions: effects on outcomes of care. *J Fam Pract*. 1999; 48(5):356–363.
18. Winkelman WJ, Leonard KJ. Overcoming structural constraints to patient utilization of electronic medical records: a critical review and proposal for an evaluation framework. *J Am Med Inform Assoc*. 2004;11(2):151–161.
19. Staroselsky M, Volk LA, Tsurikova R, et al. Improving electronic health record (EHR) accuracy and increasing compliance with health maintenance clinical guidelines through patient access and input. *Int J Med Inform*. 2006;75(10–11):693–700.
20. Kuhn P. Patient portals. *Health Inf Technol*. 2008;29(10):44–43.
21. Krohn R. The consumer-centric personal health record—it's time. *J Healthc Inf Manag*. 2006;21(1):20–23.
22. Segall A. Sick role concepts and health behavior. In: Gochman DS, ed. *Handbook of Health Behavior Research I: Personal and Social Determinants*. New York: Plenum; 1997:289–301.
23. Parsons T. *The Social System*. Chicago, IL: RKP; 1951.
24. Bull SS, Gaglio B, McKay HG, Glasgow RE. Harnessing the potential of the Internet to promote chronic illness self-management: diabetes as an example of how well we are doing. *Chronic Illn*. 2005;1(2):143–155.
25. Bergman DA, Brown NL, Wilson S. Teen use of a patient portal: a qualitative study of parent and teen attitudes. *Perspect Health Inf Manag*. 2008;5:13.
26. Broom A. Virtually He@lthy: the impact of Internet use on disease experience and the doctor-patient relationship. *Qual Health Res*. 2005;15:325–344.
27. Fox S, Rainie L. *The Online Health Care Revolution: How the Web Helps Americans Take Better Care of Themselves*. Washington, DC: Pew Internet & American Life Project; 2000.
28. Fox S, Fallows D. *Internet Health Resources: Health Searches and Email Have Become More Commonplace, But There Is Room for Improvement in Searches and Overall Internet Access*. Washington, DC: Pew Internet & American Life Project; 2003.
29. Harris Interactive. Number of "cyberchondriacs"—adults going online health information—has plateaued or declined. http://www.harrisinteractive.com/harris_poll/index.asp?PID=937. Accessed July 16, 2010.
30. Fox S. *The Engaged E-Patient Population*. Washington, DC: Pew Internet & American Life Project; 2008.