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Measuring the Impact of Patient Portals: What the Literature Tells Us

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by
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About the Author

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About the Foundation

The **California HealthCare Foundation** works as a catalyst to fulfill the promise of better health care for all Californians. We support ideas and innovations that improve quality, increase efficiency, and lower the costs of care. For more information, visit us online at www.chcf.org.

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I. Introduction

PATIENT PORTALS CAN OFFER IMPORTANT benefits to patients and provider organizations. These technologies—particularly when integrated with an electronic health record (EHR)—have the potential to improve both quality and access to care through features that enable patients to: communicate electronically and securely with their provider; access their medical records; schedule appointments; pay bills; and refill prescriptions. By providing these tools as well as easy access to online resources, portals have the potential to benefit providers by increasing care efficiency, improving the management of chronic illness, and actively engaging patients and families in care.

This report examines published peer-reviewed studies and other research documenting the implementation of patient portals and their impact on health care delivery. It is intended to inform the work of health care providers—particularly safety-net organizations—as they plan and implement patient portals and develop measurement strategies for assessing their impact on patient care. The paper is part of a larger CHCF initiative to engage early-adopter safety-net clinics in planning, implementation, and evaluation of patient portals to improve patient and family engagement, clinical outcomes, and operational efficiency.¹

Definitions

The terms *electronic health record*, *personal health record*, and *patient portal* can be generally defined as follows:

Electronic Health Record (EHR). An EHR is generated by a health care provider to document patients' medical and health information on a continuing basis. It may contain demographic data, progress notes, problems, medications, vital signs, past medical history, immunizations, laboratory data, and radiology reports. The EHR can support clinical activities including evidence-based decision support, quality management, and outcomes reporting. It can automate and streamline the clinician's workflow. An EHR is not directly accessed by patients, although certain data may be made available through a patient portal.

Personal Health Record (PHR). A PHR is owned and controlled by the individual patient (or proxy), and may have information that is not contained in a medical record. It is used for managing health information, promoting health maintenance, and assisting with chronic disease management. Common e-health tools focus on health information, behavior change/prevention, and self-management.

Patient Portal. A patient portal is a secure Web site through which patients can access a PHR and often certain information from an EHR. Portals typically enable users to complete forms online, communicate with their providers, request prescription refills, pay bills, review lab results, or schedule medical appointments. These tools can benefit patients and providers by enhancing patient access and increasing administrative efficiency and productivity.

II. Background—EHR and Patient Portal Adoption

Benefits of Portals and EHRs

The use of health information technologies and online resources has great potential to boost care quality by improving care access, efficiency, chronic disease management, and patient and family involvement.² To facilitate access to online resources, a number of health care organizations have created patient portals. When integrated with an EHR and other electronic health information, portals can offer features that enhance patient-provider communication and enable patients to schedule appointments, pay bills, refill prescriptions, and access lab results. A recent survey found that people pay more attention and become more engaged in their health and medical care when they have easy access to their health information online—and that this is especially true for those with lower incomes.³

Patient access to a portal also can result in longer-term payoffs, such as greater administrative efficiencies (e.g., reduced call volume) and improved responsiveness to patients' needs.⁴ Although patient portals have the potential for these longer-term payoffs, there are only a handful of peer-reviewed publications and other reports that have formally documented their impact. This is especially true for the safety-net population, where adoption of the patient portal by community clinics and health centers is very low. However, there are anecdotal reports, stories, and case studies from which to draw lessons about measurement and the impact of patient portals on quality and efficiency. Federally funded projects are in progress to document measures used in these studies.

Barriers and Incentives

Despite the potential advantages to patients and providers, adoption of portals and EHRs has been slow in California, due to several of barriers to implementation. In addition to concern about cost, providers worry about the potential for added work, lack of reimbursement, inappropriate use, and liability issues, among others.⁵ Research published in 2006 suggested that patient portals tended to be used more by affluent, younger, white, and healthier patients.⁶

By 2008, EHR adoption among safety-net providers was reported at less than 4 percent in California⁷ and less than 10 percent nationwide.⁸ The biggest barriers were purchasing and implementation expenses.⁹ Other obstacles included resistance to change in practice style, staff retraining needs, lack of internal expertise, fear of product failure, and lack of evidence on return on investment.¹⁰

However, it is likely that adoption of patient portals will grow, particularly since a number of the meaningful use criteria for Stage 1 established by the Centers for Medicare and Medicaid Services focus on patient engagement, with higher patient engagement thresholds anticipated for Stages 2 and 3.¹¹

Also, growing interest in patient-centered care nationwide is leading some providers to embrace the idea of “patient-centered health information technology.”¹² Promising models such as the “patient-centered medical home” include health information technology and analytic tools.^{13–15} Further, there has been a proliferation of new products and technologies that foster health care consumerism, including telemedicine, clinical decision support, EHRs, and health intelligence.¹⁶ Research shows

that a majority of consumers (72 percent) would use a tool to help them pay their medical bills, communicate with doctors, make appointments, and obtain lab results online.¹⁷

In addition, a major federal incentive program seeks to reward providers with bonuses if they can demonstrate that they are making “meaningful use” of EHRs.¹⁸ The Health Information Technology for Economic and Clinical Health Act (HITECH) provisions were designed to improve the quality and coordination of health care through the meaningful use of EHRs. Moving the health care infrastructure to an electronic framework holds promise in improving clinical decisionmaking, documentation, and patient safety, and ultimately administrative efficiency, improved access, and better patient outcomes.^{19–21} While it is expected that HITECH will transform the way information is exchanged, the framework faces a number of challenges in widespread adoption of EHRs even with the availability of incentive payments by Medicare and Medicaid.²²

To help speed the adoption of EHRs in California, the California Network for Electronic Health Record Adoption (CNEA) initiative was launched in 2006 by three health care foundations. The CNEA strategy included the development of centralized support hubs that provided clinics with EHR technology, technical expertise, vendor management, and other services.²³

III. Research on Patient-Level Measures

TWO TYPES OF MEASURES ARE HELPFUL IN assessing an EHR-integrated patient portal. Short-term, patient-level measures can help clinicians document how successful they are at *implementing* a patient portal, while long-term measures help document the *impact* on clinical outcomes and operational efficiency. A summary of the literature addressing these two types of measures is presented below and summarized in the Appendix.

Given the paucity of research on the impact of patient portals on health care utilization, peer-reviewed studies and unpublished reports most commonly document *characteristics* of portal users and overall *uptake* (i.e., portal usage) by patients. Many of the studies and reports looked at frequency of use of patient portal features. This measure is important in improving the usability of portals through user feedback, and also it can be linked with clinical data to document longer-term changes in patient behavior, clinical outcomes, utilization, and operational efficiency.

In the majority of studies reviewed, the most frequently used patient portal features were similar across studies, patient populations, and type of health care delivery system. In general, the most frequently accessed portal features for regular users include viewing laboratory results, scheduling appointments, secure messaging with providers, and prescription refills.

A literature search uncovered the examples that are described below. They are arranged by area of special focus, although there is considerable overlap in groupings.

Volume and Demographics of Users

- **myGeisinger.** Geisinger Health System, an integrated health system and health plan located in Danville, Pennsylvania, launched a patient portal, myGeisinger, in 2002. About 25 percent of the system's primary care patients are registered with the portal, with an expansion of about 2,000 patients per month. Most users fall into three groups— young parents, family members caring for elderly parents, and patients with chronic illnesses.²⁴
- **KP HealthConnect Online.** Kaiser Permanente, an integrated delivery system with 8.5 million members, launched KP HealthConnect™ Online in 2002 for members of its Northwest region. In 2005, Kaiser reported that 6 percent of its adult population in the region were registered users of its integrated EHR. By 2009, about 25 percent were registered.²⁵ A tripling of registrations between 2005 and 2008 coincided with improved health record functionality, including availability of online test results and secure emails to providers.²⁶ The online users were significantly more likely to be older and have diabetes, compared to the general adult membership.²⁷

Kaiser has been collecting user data on its member population since 2004.²⁸ By 2007, the system documented more than 90,000 visits per day to its member Web site. Between 2004 and 2007, the three most-visited features were review of laboratory tests, prescription refills, and email messages to providers.²⁹ Kaiser also documented the leading reasons for patients to email their physicians: discussion of a change in health

condition, laboratory results, new condition, prescription dose, or the need for a new prescription. Sixty-three percent of the patient-initiated emails required clinical assessments or decisions, and 24 percent required clinical actions (such as a laboratory test).³⁰

Kaiser's patient portal and personal health record, My Health Manager, is used by more than 3 million members.³¹ Silvestre et al.³² reported that members who use the Web site are more likely to be female (60 percent) and between the ages of 40 and 60 (although the age range of site users is 13 to 95 years). A survey of registered users also found that half of the survey sample reported household annual incomes of less than \$75,000, and almost half had not completed a college degree. The percentage of registered users who accessed the site two or more times in a six-month period more than doubled from 28 percent in 2005 to 62 percent in 2007.

- **My HealthVet.** The U.S. Department of Veterans Affairs offers an online personal health record to veterans, active duty soldiers, and their dependents and caregivers. Users of MHV have access to health care information and services, including access to personal health journals, vitals tracking, activity and food journals, and medication refills.³³ There are three levels of MHV access with increasing functionality with each level.³⁴ In addition, MHV uses veteran feedback to guide improvements with the portal and add-on features. As of March 2010, it was reported that MHV received over 38 million visits with over 976,000 registered users, 75 percent of whom are VA patients.³⁵

Although the health care systems described above have been successful in recruiting users to their patient portals, other studies have reported slow uptake.

- **HealthSpace.** Using Kaiser's experiences as a model, the British National Health Service launched HealthSpace in 2007, an Internet-based personal electronic health record.³⁶ Users are able to sign up for a basic account to enter values or record appointments on a calendar; through an advanced account, they can gain access to their summary care record, schedule appointments, or exchange secure emails with their provider.

However, by October 2010, only 0.13 percent of individuals invited to open up an advanced HealthSpace account had actually activated their account. The authors reported that low uptake was due, in part, to limited interest by patients and a cumbersome and bureaucratic registration process. The original business plan anticipated that about 10 percent of the patient population would register for an advanced HealthSpace account. The authors noted that the software is being upgraded with improvements in functionality.

- **PatientSite.** Weingart et al.³⁷ reported on users of the PatientSite Web portal, which was introduced in 2000 at a Boston teaching hospital and affiliated community practices. Over a four-year period, more than 18,000 patients enrolled in the portal and logged on at least once. PatientSite enrollees were more likely than non-enrollees to be White and less likely to have Medicare or Medicaid insurance. Enrollees also tended to be healthier; they had fewer prescriptions, medical problems, office visits, and hospitalizations than non-enrollees.

Opinions and Concerns of Users

Some quantitative and qualitative research went beyond demographic assessments to look at which online features are popular and what user concerns are. Following are examples.

In a small pilot study of Medicaid beneficiaries in North Carolina, individuals were very concerned about having their personal health information available online, and estimated that their actual use would be just a few times a year. The research also found that these beneficiaries were most interested in accessing portal services related to prescription refills, scheduling appointments, and communicating with their provider, which is consistent with most other studies.³⁸ In contrast to other reports, the sample of Medicaid beneficiaries was least interested in laboratory test results.

These results contrast somewhat with research on the Institute for Family Health's HRSA-funded patient portal, MyChart-MyHealth. The Institute provides services to about 72,000 patients in Manhattan, the Bronx, and mid-Hudson Valley—including 13 percent uninsured and 44 percent publicly insured patients. Focus group findings indicated that patients were not as concerned about privacy and confidentiality as anticipated. Further, the research found that participants were concerned that the patient portal might actually hinder communication with their providers, which is consistent with the findings from other studies described below.³⁹ The portal had 1,100 patients signed-up as of February 2009. The most frequently used features were: viewing test results, secure email messaging, prescription refills, and problem and medication list viewing.⁴⁰ Rockoff reported that as of December 2010, 16,366 access codes were generated for MyChart-MyHealth and 59 percent were “users” (i.e., the portal was used more than once after initial activation).⁴¹

Patient-provider interaction was one of the focuses of a pilot study of My Wellness Portal conducted through the Oklahoma Physicians Resource/Research Network.⁴² While the majority of patients found the portal to be a valuable resource, only 60 percent believed it improved patient-provider interactions. On the other hand, Tang and Lansky⁴³ reported that users of PAMFOnline, a personal health record available to patients of the Palo Alto Medical Foundation (PAMF), felt more connected to their providers than non-users did. PAMF launched its personal health record in 2002, and it provides patients with access to medical records, appointments, prescription refills, and secure emails with their providers. Over 90 percent of patients and physicians are satisfied with PAMFOnline.

Patients with Chronic Illness

A small number of studies have documented the use of patient portals for individuals with chronic illnesses, particularly diabetes. Health information technology with real-time interactions can enhance the effects of chronic disease management, particularly when used in conjunction with behavior change programs.⁴⁴

An interesting qualitative study by Zickmund et al.,⁴⁵ documented the impact of the patient-provider relationship on use of a patient portal. The researchers conducted ten focus groups with patients with diabetes to better understand the link between the patient-provider relationship and use of the University of Pittsburgh Medical Center's (UPMC) HealthTrak, a portal that includes online tracking of patient-entered glucose, blood pressure, and physical activity. The portal was offered to patients from two internal medicine and two family medicine practices in the greater Pittsburgh area.

Two themes emerged from the UPMC research. First, interest in portal use appeared to be linked to

dissatisfaction with the patient-provider relationship; and, second, disinterest in portal use appeared to be linked to *satisfaction* with the relationship. The findings underscore the importance of maintaining the patient-provider relationship even when (or especially when) health information technologies are introduced to improve medical care. As described by the researchers, “some participants in our study were worried that the use of the portal would gradually erode their ability to communicate with their health care team. The suspicion of the portal supports the relative importance participants place on the traditional patient-provider relationship....”

A qualitative study of the UPMC patient portal was conducted by Hess and colleagues⁴⁶ to obtain feedback from patients with diabetes on portal features that would be of value to them. Top features identified by patients included a log for tracking blood glucose levels and a calculator to estimate average glucose control. When asked to estimate a dollar value for monthly access to the portal, nine of 17 patients gave a value of zero. The investigators reported that although users saw positive value in the portal, they were not supportive in paying to maintain the costs of the portal. However, Adler noted that in a survey of patients in his own practice, patients were willing to pay a small annual subscription for access to a patient portal: 60 percent of Internet-using patients were willing to pay \$10 or more per year and about one-third of patients were willing to pay \$50 or more each year. In addition, the three services of most interest to patients included Web messaging with their provider, access to their medical record, and prescription refills.⁴⁷

The Healthcare Evaluation Record Organizer (HERO) is a Web-based EHR used by the San Francisco General Hospital HIV/AIDS Program’s Ward 86 clinic. HERO is integrated with myHERO, which is a personal health record that enables

patients to view lab results, obtain prescription refills, view their medical problems, and update health information. The program emphasizes self-management support, so that patients can take action to manage their own health. Patients without computers can get access in the clinic waiting room. In addition, because many of the patients were homeless at the time the report was published in 2009, plans were being made for a mobile platform for patients.⁴⁸

Ross et al.,⁴⁹ conducted a randomized trial to determine characteristics of patients using Diabetes-STAR and whether personalized content facilitated sustained use of the patient portal. While the initial log-on to the patient portal was the same between the intervention group and the control group, patients exposed to the personalized portal used the portal for twice as many days as the control group. The authors concluded that interactive content resulted in sustained use.

Focus on Young People

A few studies and reports have documented the use of patient portals by adolescent populations. Bourgeois et al.,⁵⁰ reported on the implementation of MyChildren’s, a provider-tethered portal that allows patients and their guardians access to a personal health record. Features of the portal include access to patient health information, secure messaging, billing, and scheduling appointments. The information released to the “personally controlled health record” reverts to the control of the patient or guardian to ensure transparency of the health information. In addition, patients or their guardians may choose to hide selected problems, medications, or results, making them invisible to any other user of the PHR. MyChildren’s was launched hospitalwide in 2009 at Children’s Hospital Boston with over 900 active accounts within three months of full launch. The

mean patient age was nine years. The most frequently accessed features included lab results and summary forms.

Bergman et al.,⁵¹ conducted a qualitative study using a series of focus groups of teens and parents to better understand their attitudes toward use of a patient portal. Patient portals may enhance communications between providers and adolescents, particularly for services that require confidentiality between the teen and provider. Focus group participants were patients of primary care providers at the Palo Alto Medical Foundation. In general, while both parents and adolescents were enthusiastic about using the portal, teens and parents had conflicting feelings about what should be shared with parents and what should remain confidential. Teens were more comfortable in scheduling appointments or communicating with their providers through email as opposed to talking in person. In addition, while some parents wanted to know exactly what services they were being billed for, teens felt strongly that their parents should only see general billing information without detailed charges for more sensitive services. The authors concluded that the patient portal can enhance communications between teens and their parents, and that negotiation about confidentiality issues would be the best solution.

IV. Research Linking Portals with Clinical Outcomes and Operational Efficiency

BECAUSE THE PATIENT PORTAL IS A RELATIVELY recent technology, studies evaluating portals' impact have only recently emerged in the literature, and studies on the cost-effectiveness have not yet been published. However, some limited information is available.

Research linking patient portal use to clinical outcomes and operational efficiency is summarized below. Most of these studies were conducted through integrated health care delivery systems—particularly systems with mature, integrated EHRs. However, it is not possible to disentangle the contributions of EHRs and patient portals on health care utilization—although there may not be any practical reason to do this given the feature-rich services offered through bundling these complementary HITs.

Phone Volume and Web Messaging Availability

Liederman et al.,⁵² conducted a study using one primary care practice as the case study site and one as a control site from the Sacramento, California region (part of the University of California Davis Health System's primary care network). The case clinic's telephone and total incoming message volume were compared to that of the control site using data from November 2001 to November 2002. The hypothesis was that incoming patient message volume would not differ between sites using and not using patient Web messaging, and phone call volume would decrease at the site using Web messaging.

The investigators documented that the case call volume averaged 18.2 percent less than that of the control clinic (21.6 versus 26.4 calls per 1,000 panel

patients per workday) and fell over six times faster. Case message (i.e., phone plus Web messages) volume averaged 13.7 percent less than that of the control clinic (i.e., phone only) (22.8 versus 26.4 total messages per 1,000 panel patients per workday) and fell nearly six times faster. The investigators suggested that with the decline in total message volume, Web messaging may have enhanced the efficiency of non-visit care.

Impact on Types of Patient Contacts

Chen et al.,⁵³ conducted a retrospective study using 2004–2007 administrative data from the Kaiser Permanente Hawaii region, the first region to fully implement KP HealthConnect™ in the outpatient setting. The purpose of the study was to document the impact of the portal on outpatient, urgent care, and emergency department visits, referrals, telephone visits, and patient-physician email messaging.

The researchers found that per member age- and sex-adjusted office visits decreased 26 percent and per member scheduled telephone visits increased almost nine-fold over the study period. Secure online patient-physician messaging increased significantly between 2005 and 2007 (an increase of 0.03 messages/member to 0.23 messages/member). The total number of patient contacts (i.e., office visits, telephone visits, emails) increased 8.3 percent following EHR implementation. A majority of trends in Healthcare Effectiveness Data and Information Set (HEDIS) scores for nine measures of Kaiser's commercial and Medicare populations were "favorable" over the course of the study period. In addition, Kaiser member satisfaction ratings of overall visit satisfaction, level of interest and attention

of their health care providers, and satisfaction with telephone visits, remained unchanged over the study period.

Patient-Physician Messaging and Visit/Phone Rates

In a study conducted in Kaiser's Northwest region, Zhou and colleagues⁵⁴ documented the impact of secure patient-physician messaging on primary care office visit and telephone contact rates. The researchers used a retrospective cohort study and matched case-control study of continuously enrolled Kaiser members who used HealthConnect™ for 13 months or longer and had accessed at least one feature.

Pre/post analysis indicated a decrease in annual office visit rates of 9.7 percent visits per member in the cohort study and a 6.7 percent net decrease between users and controls of the matched-control study. Also, the analysis indicated a 13.7 percent net increase in annual documented telephone contact rates between users and controls in the matched-control study. The investigators concluded that electronic messaging “may provide a win-win-win solution to pervasive efficiency and access issues from the perspectives of patient, health care provider, and payer.”

Patient-Physician Messaging and Chronic Care

A comprehensive study conducted by Kaiser documented significant improvements in care and operational efficiency among patients who use secure patient-physician messaging. Zhou et al.,⁵⁵ studied more than 35,000 Kaiser patients in Southern California with hypertension, diabetes, or both and documented an association between secure patient-physician emailing and more effective care, as measured by HEDIS scores. The investigators

focused on these two chronic conditions because of their high prevalence and high costs of care.

Using regression analysis, the investigators determined that the use of secure patient-physician email was significantly associated with improved performance for all HEDIS measures. The proportion of patients whose measures improved ranged from 4 percent to about 11 percent. Although the study did not determine *how* the use of patient-physician emailing might improve care, the researchers suggested three possible mechanisms: increased continuity of care, better patient-physician connectedness, and a greater focus on self-management supports.

Patient-Physician Messaging and Provider Productivity

In a study by Liederman, et al.,⁵⁶ the investigators compared the productivity of internal medicine and family practice physicians in the case and control sites previously described. Intervention physicians averaged about 11 percent more visits per day compared to the control group (i.e., 25 versus 23 visits per day). In addition, intervention physicians averaged about 10 percent more Relative Value Units per day than controls (50 versus 45 RVUs per day). This translated into about \$95 more per physician per day in the case site compared to the control site. The investigators concluded that email messaging improves provider productivity by freeing up time for additional patient visits and it increases patients' access to care.

Cost-Savings Estimates

Gardner,⁵⁷ in a March 2010 *Health Data Management Magazine* article, reported that some health care providers had savings of \$0.63 for mailing costs for lab results, \$17 for online billing questions (versus the telephone), and \$7 for each

appointment scheduled online. Similarly, in a report from a presentation at the 2010 Northwest Medical Informatics Symposium,⁵⁸ the secure messaging feature of the electronic medical record/patient portal could result in savings of \$0.62 per appointment reminder, \$1.75 per phone call to patients, and \$2.69 for each lab result delivery. The figures “are based on industry averages for number of communications and typical office costs” according to the presenter, although references for these figures were unavailable.

It is likely that more studies on return on investment will become available in the near future, since they represent natural follow-up studies to the more comprehensive investigations that have already documented operational efficiencies resulting from using patient portals in combination with EHRs.

V. Conclusions

PATIENT-LEVEL MEASURES COMMONLY documented by published studies and reports focus on general use statistics of patient portals (mostly use of portal features), patient demographics (with possible comparisons between portal users and non-users), patient engagement, and overall satisfaction with the portal. Most of these measures have been used to improve the functionality and reach of patient portals. Importantly, they have been used across different types of health care delivery systems and with different patient populations, including patients with chronic illnesses and medically underserved populations.

A limited number of studies bridge the gap between patient-level measures and long-term outcome measures, including health care quality indicators and operational efficiency. There is scant research on cost-savings resulting from the implementation of patient portals. However, with patient-level measures in place—and with appropriate integration with an EHR and links to other sources of administrative data—it will be possible for many clinics that adopt patient portals to eventually link this information to long-term health outcomes, operational efficiency measures, and cost-effectiveness.

Portals offer a number of potential benefits to providers, including administrative efficiencies (e.g., reduced call volume), improved responsiveness to patients' needs, decreased utilization of health services, more effective care, and cost savings. To be successful, they should be assessed using measures that span across improvements in patient and family engagement (e.g., overall use and satisfaction with

use and care), clinical outcomes, and operational efficiency.

A number of external factors will likely accelerate uptake and more widespread use of measurement strategies that incorporate impact assessment. They include: (1) the need to meet meaningful use requirements; (2) a greater focus on patient- and family-centered care; and (3) increased patient demand for health information technology. All of these factors point to the importance of seeking regular feedback from patients on portal features as a mechanism to improve and expand capabilities and increase overall access.

Appendix: Summary of Study Findings

	DOMAIN	TYPE OF HEALTH CARE SYSTEM	PORTAL AND FUNCTIONS	MEASURES REPORTED/FINDINGS [†]
Patient Level Measures				
Bergman, et al. (2008)	Portal usability; adolescent population; provider-patient relationship	Multispecialty group practice	PAMFOnline (Epic Systems): Secure messaging, view PHR, health information resources, appointments, lab results, prescriptions, billing	Focus groups of teens and parents indicated that: teens were concerned about confidentiality while parents felt they would be 'out of the loop'; also, the portal could improve communications with providers
Bourgeois, et al. (2009)	Portal usability; pediatric and adolescent population	Pediatric tertiary care center	MyChildren's (Indivo open source PCHR, Children's Hospital Boston): PHR, secure messaging, appointments, billing, information sharing	Trends in use; portal features used; feedback survey to evaluate user satisfaction, ease of use, and impact on access to and communication of health information
Chou, et al. (2010)*	Provider-patient relationship	Primary care practices	My Wellness Portal (University of Oklahoma Health Sciences Center): Secure messaging, lab results, preventive services, risk factors, symptoms tracking, health education, health tracking, appointment tracking, update PHR, symptom diary	Portal features used; only 60 percent of field test participants believed it improved patient-provider interactions
Gardner (2010)	Characteristics of portal users	Integrated	myGeisinger (Epic Systems): PHR, lab results, billing, health and fitness data, prescription renewal, appointments, secure messaging	Trends in enrollment; portal features used; 3 clusters of users: young parents; family members caring for elderly parents; patients with chronic illnesses
Kanaan (2009)	Portal usability; disease management	Primary care clinic; outpatient primary and specialty HIV/AIDS care	Healthcare Evaluation Record Organizer (HERO)/MyHERO (UCSF): PHR, prescriptions, lab results, health information resources	Periodic feedback from patients on key features; portal features used
Rockoff (2010)	Portal usability	Primary care centers	MyChart-MyHealth (Epic Systems): Secure messaging, appointments, billing, health education, administrative requests, prescriptions, problem lists, medication lists, lab results	Trends in enrollment; portal features used; focus groups indicated patients were not as concerned about privacy and confidentiality as anticipated, but concerned that portal might actually hinder communication with providers
Ross, et al. (2006)	Portal usability; disease management	Primary care clinics	Diabetes-STAR: Personalized diabetes self-management information; goal setting; lab results; clinical notes	Trends in use; portal features used; personalized and interactive content resulted in more sustained use compared with generic content

*Pilot study.

[†]Studies that report on portal features used are noted, although specific features are not reported for each of these studies. In general, the most frequently used patient portal features are similar across studies, patient populations, and type of health care delivery system. The most frequently accessed portal features for regular users include viewing laboratory results, scheduling appointments, secure messaging with providers, and prescription refills.

DOMAIN	TYPE OF HEALTH CARE SYSTEM	PORTAL AND FUNCTIONS	MEASURES REPORTED/FINDINGS [†]	
Patient Level Measures, <i>continued</i>				
Silvestre, et al. (2009)	Characteristics of portal users	Integrated	KP HealthConnect™ Online (Epic Systems) and My Health Manager (PHR): View medical record, lab results, secure messaging, medications, visit reminders, appointments, prescriptions, proxy access, health education, account management	Trends in enrollment; portal features used; 60% female; mean age: 48; age range: 13 to 95; based on Web survey, half of sample reported annual income of <\$75K and nearly half without college degree
Tang and Lansky (2005)	Provider-patient relationship	Multispecialty group practice	PAMFOnline (Epic Systems): Secure messaging, view PHR, health information resources, appointments, lab results, prescriptions	Portal features used; qualitative feedback from a patient survey indicated that users felt like a team member in their own care and more connected to their providers
Weingart, et al. (2006)*	Characteristics of portal users	Hospital-based primary care practices	PatientSite (developed by Beth Israel Deaconess Medical Center): Secure messaging, appointments, referrals, view PHR and add comments, administrative requests, prescriptions, lab results	Trends in enrollment; portal features used; compared to non-enrollees, PatientSite enrollees more likely to be white, younger, healthier, less likely to have Medicaid or Medicare insurance
Zhou, et al. (2007)	Characteristics of portal users	Integrated	KP HealthConnect™ Online (Epic Systems): PHR, administrative requests, appointments, after-visit summary, secure messaging	Trends in enrollment; portal features used; older patients; members with diabetes
Zickmund, et al. (2007); also see Hess, et al. (2006)	Provider-patient relationship	Primary care practices	HealthTrak (University of Pittsburgh Medical Center): Secure messaging, online information, lab results, diabetes self-management	Focus groups indicated that interest in portal use appeared to be linked to dissatisfaction with the patient-provider relationship; and disinterest in portal use appeared to be linked to satisfaction with the relationship
Clinical Outcomes and Operational Efficiency				
Chen, et al. (2009)	Administrative efficiency	Integrated	KP HealthConnect™ Online (Epic Systems): PHR, secure messaging	Retrospective study using administrative data, 2004–2007: <ul style="list-style-type: none"> • Office visits: ↓ 26% • Telephone visits: ↑ 9-fold • Online messaging: ↑ 0.03 to 0.23 (messages/member)

*Pilot study.

[†]Studies that report on portal features used are noted, although specific features are not reported for each of these studies. In general, the most frequently used patient portal features are similar across studies, patient populations, and type of health care delivery system. The most frequently accessed portal features for regular users include viewing laboratory results, scheduling appointments, secure messaging with providers, and prescription refills.

DOMAIN	TYPE OF HEALTH CARE SYSTEM	PORTAL AND FUNCTIONS	MEASURES REPORTED/FINDINGS [†]
Clinical Outcomes and Operational Efficiency, <i>continued</i>			
Liederman, et al. (2005)	Administrative efficiency	UC-Davis Primary Care Network	University of California Davis Health System web messaging system (RelayHealth Corp.): Prescription refills, appointments, test results
			Trends in patients enrolled; telephone and message volume and types Retrospective case-control study: <ul style="list-style-type: none"> • Case call volume: 22 vs. 26 (case vs. control clinic calls/1,000 patients/workday) • Case message volume (web and call): averaged 14% ↓ in case clinic and ↓ six times faster than control clinic • Conclusion: Web messaging may have enhanced efficiency of non-visit care
Liederman, et al. (2005)	Administrative efficiency; physician productivity	UC-Davis Primary Care Network	University of California Davis Health System web messaging system (RelayHealth Corp.): Prescription refills, appointments, test results
			Case-control study (i.e., Web messaging vs. not) Compared productivity of physicians: <ul style="list-style-type: none"> • Visits/day: 25 vs. 23 (case vs. control clinic) • RVUs/day: 50 vs. 45 (case vs. control clinic) • Net ↑ \$95/physician/day (case clinic)
Zhou, et al. (2007)	Administrative efficiency	Integrated	KP HealthConnect™ Online (Epic Systems): View medical record, lab results, secure messaging, medications, visit reminders, appointments, prescriptions, proxy access, health education, account management
			Retrospective cohort and matched case-control study: <ul style="list-style-type: none"> • Annual office visit rates: ↓ 9.7% visits/member in cohort; 6.7% net ↓ between users and controls • Annual telephone contacts between users and controls: 13.7% net ↑
Zhou, et al. (2010)	Quality of care; disease management	Integrated	KP HealthConnect™ Online (Epic Systems): View medical record, lab results, secure messaging, medications, visit reminders, appointments, prescriptions, proxy access, health education, account management
			Retrospective longitudinal and observational study: <ul style="list-style-type: none"> • 35,000 patients with diabetes, hypertension, or both • Use of secure patient-physician email was associated with improved performance on HEDIS measures • Proportion of patients whose HEDIS measures improved ranged from 4 to 11 percent • Email messaging may have improved care through increased continuity of care, better physician-patient connectedness, or a greater focus on self-management supports

*Pilot study.

†Studies that report on portal features used are noted, although specific features are not reported for each of these studies. In general, the most frequently used patient portal features are similar across studies, patient populations, and type of health care delivery system. The most frequently accessed portal features for regular users include viewing laboratory results, scheduling appointments, secure messaging with providers, and prescription refills.

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