APPENDIX A. SEARCH STRATEGY

CONSUMER HEALTH INFORMATION TECHNOLOGY SEARCH METHODOLOGIES

DATABASE SEARCHED & TIME PERIOD COVERED:
PubMed – 1990-12/3/2010

LANGUAGE:
English

SEARCH STRATEGY #1:
"Electronic Health Records"[Mesh] OR "electronic health record" OR "electronic health records" OR "electronic medical record" OR "electronic medical record" OR messaging OR email* OR "computerized alert" OR "computerized alerts" OR "computerized reminder" OR "computerized reminders" OR "computerised reminder" OR "computerised reminders" OR electronics, medical OR informatic*[tiab] OR computerized physician order entry OR computerised physician order entry OR computer provider order entry OR cpoe OR e-prescrib* OR e-prescription* OR electronic prescrib* OR electronic prescription* OR e-health
AND
patient*[ti] OR consumer*[ti] OR patient*[mh] OR consumer*[mh] OR tether* OR secure OR self-report* OR self report*
NOT
case report OR case reports OR case report[pt] OR case reports[pt]

NUMBER OF RESULTS: 2381

SEARCH STRATEGY #2:
"Electronic Health Records"[Mesh] OR "electronic health record" OR "electronic health records" OR "electronic medical record" OR "electronic medical record" OR messaging OR email* OR "computerized alert" OR "computerized alerts" OR "computerized reminder" OR "computerized reminders" OR "computerised reminder" OR "computerised reminders" OR electronics, medical OR informatic*[tiab] OR computerized physician order entry OR computerised physician order entry OR computer provider order entry OR cpoe OR e-prescrib* OR e-prescription* OR electronic prescrib* OR electronic prescription* OR e-health
AND
reminder*
NOT
case report OR case reports OR case report[pt] OR case reports[pt]
NOT
Results of Search Strategy #1

NUMBER OF RESULTS: 353

SEARCH STRATEGY #3:
["Electronic Health Records"[Mesh] OR "electronic health record" OR "electronic health records" OR "electronic medical record" OR "electronic medical record" OR messaging OR email* OR "computerized alert" OR "computerized alerts" OR "computerized reminder" OR "computerized reminders" OR "computerised reminder" OR "computerised reminders" OR electronics, medical OR informatic*[tiab]

OR computerized physician order entry OR computerised physician order entry OR computer provider order entry OR cpoe OR e-prescrib* OR e-prescription* OR electronic prescrib* OR electronic prescription* OR e-health OR "Medical Records Systems, Computerized"[Mesh]
AND
patient*[ti] OR consumer*[ti] OR patient*[mh] OR consumer*[mh] OR tether* OR secure OR self-report* OR self report*
NOT
case report OR case reports OR case report[pt] OR case reports[pt]]
OR
["Electronic Health Records"[Mesh] OR "electronic health record" OR "electronic health records" OR "electronic medical record" OR "electronic medical record" OR messaging OR email* OR "computerized alert" OR "computerized alerts" OR "computerized reminder" OR "computerized reminders" OR "computerised reminder" OR "computerised reminders" OR electronics, medical OR informatic*[tiab] OR computerized physician order entry OR computerised physician order entry OR computer provider order entry OR cpoe OR e-prescrib* OR e-prescription* OR electronic prescrib* OR electronic prescription* OR e-health OR "Medical Records Systems, Computerized"[Mesh]
AND
reminder*
NOT
case report OR case reports OR case report[pt] OR case reports[pt]]
NOT
Results of Search Strategy #1

NUMBER OF RESULTS: 2804

TOTAL OF ALL SEARCHES AFTER REMOVAL OF DUPLICATES: 4607

APPENDIX B. STUDY SELECTION FORM

ID:

1. Is this consumer HIT?

- ☐ Not HIT (STOP)
- ☐ HIT

2. Functionalities discussed in the article:

- ☐ Messaging programs
- ☐ Patient access to own medical record
- ☐ Patient self-reported data (specify)
- ☐ Online preventive or chronic care reminders (specify)
- ☐ Other (STOP)

3. What is the study design?

- ☐ Descriptive qualitative
- ☐ Descriptive quantitative
- ☐ Hypothesis testing
- ☐ Systematic review
- ☐ Non-systematic review (STOP)
- ☐ Commentary/news (STOP)
- ☐ Other (STOP)
- ☐ N/A, Not reported (STOP)

4. Study Origin

- ☐ US
- ☐ Non-US
- ☐ Not clear/Unknown

5. If STOP, save for background?

- ☐ Yes

6. Is study from a VA peer organization?

- ☐ Kaiser Permanente
- ☐ Group Health Cooperative
- ☐ Geisinger Health System
- ☐ Partners HealthCare
- ☐ Palo Alto Medical Foundation
- ☐ None
- ☐ Not Reported
- ☐ VA

Which outcomes are reported?

7. Clinical Outcomes

- ☐ Health outcomes
- ☐ Patient satisfaction
- ☐ Provider satisfaction
- ☐ Patient-provider communication
- ☐ Self-management
- ☐ Adherence (medication, visit)
- ☐ Other (specify) _____

8. System-level outcomes

- ☐ Efficiency/Utilization
- ☐ Privacy breaches
- ☐ Patient safety
- ☐ Other (specify) _____

9. Other outcomes

- ☐ Attitudes
- ☐ Usability

APPENDIX C. CRITERIA USED IN QUALITY ASSESSMENT

A summary of GRADE's approach to rating quality of evidence[58]

Study design	Initial quality of a body of evidence	Lower if	Higher if	Quality of a body of evidence
Randomized trials	High ⇒	Risk of Bias -1 Serious -2 Very serious Inconsistency -1 Serious -2 Very serious Indirectness -1 Serious -2 Very serious Imprecision -1 Serious -2 Very serious Publication Bias -1 Likely -2 Very likely	Large Effect +1 Large +2 Very large Dose response +1 Evidence of a gradient All plausible residual confounding +1 Would reduce a demonstrated effect +1 Would suggest a spurious effect if no effect was observed	High (four plus: ⊕⊕⊕⊕) Moderate (three plus: ⊕⊕⊕◯) Low (two plus: ⊕⊕◯◯) Very low (one plus: ⊕◯◯◯)
Observational studies	Low ⇒			

APPENDIX D. PEER REVIEW COMMENTS/AUTHOR RESPONSE

Prompt	Comment	Response
Are the objectives, scope, and methods for this review clearly described?	The dates of the literature review are stated as "1999 through 12/03/2010"…to improve consistency provide start and end dates in same format (e.g. 01/01/1999 through 12/03/2010).	This suggestion has been incorporated.
Are there any published or unpublished studies that we may have overlooked?	The exclusion of descriptive qualitative studies appears to be a shortcoming considering the infancy of this field and the limited availability of data about the use and efficacy of Secure Messaging, Personal Health Records, and Web-based Management Systems. The inclusion of at a minimum a summary of the qualitative findings to date could provide insights to the facilitators and barriers to use and possibly inform the "why" factor to these reported quantitative findings.	We evaluated the descriptive qualitative papers and identified those that were potentially studies of patient portals that discussed barriers and facilitators. We identified four such studies for inclusion, two of which were of the same system, that we felt were reasonable to include. A fifth study involved focus groups evaluating a "potential" system and was not included. A sixth study evaluated patient opinions regarding access to records from a kiosk in the practice waiting room in London and was not included.
	J Gen Intern Med. 2003 Sep;18(9):736-44. Effect of a triage-based E-mail system on clinic resource use and patient and physician satisfaction in primary care: a randomized controlled trial.	The email system presented does not match our definition of secure messaging. Insecure email was outside the purview of our current scope.
	Randomized Trials: 1. McCarrier KP, Ralston JD, Hirsch IB, et al. Web-based collaborative care for type 1 diabetes: a pilot randomized trial. Diabetes Technol Ther. Apr 2009;11(4):211-217. (U of Washington Study) 2. Simon GE, Ralston JD, Savarino J, Pabiniak C, Wentzel C, Operskalski BH. Randomized trial of depression follow-up care by online messaging. J Gen Intern Med. 2011. (Group Health Study)	McCarrier: Our original search only found the companion to this article. We have now included this article as well. Simon and Lyles: These articles were too recent for our original search, however our updated search did include them. They have now been incorporated into the report.

Prompt	Comment	Response
(*Continued)* Are there any published or unpublished studies that we may have overlooked?	Papers Addressing Potential Disparities in Access to SM and Patient Access to Records: 1. Lyles CR, Harris LT, Jordan L, et al. Patient race/ethnicity and shared medical record use among diabetes patients. Med Care. 2011. (Group Health)	
	2. Roblin DW, Houston TK, 2nd, Allison JJ, Joski PJ, Becker ER. Disparities in use of a personal health record in a managed care organization. J Am Med Inform Assoc. Sep-Oct 2009;16(5):683-689. (Kaiser)	Roblin: This article has now been included in a new section on patient characteristics associated with use of a patient portal/ tethered PHR.
	3. Sarkar U, Karter AJ, Liu JY, et al. The literacy divide: health literacy and the use of an internet-based patient portal in an integrated health system-results from the diabetes study of northern California (DISTANCE). J Health Commun. 2010;15 Suppl 2:183-196. (Kaiser)	Sarkar: We have included this article in a new section on patient characteristics associated with use of a patient portal/tethered PHR.
	Wald JS, Grant R, Schnipper J, Gandhi T, Poon E, Businger A, Orav E, Williams D, Volk L, Middleton B. Survey analysis of Patient Experience using a Practice-linked PHR for Type 2 Diabetes Mellitus. AMIA Annu Symp Proc 2009:678-82.	Wald 2009: This article reports on a subset of patients that are included in the Grant 2008 article below and the previously included Wald 2010 artucle, and is thus an exclude.
	{post 12/3/2010}Wright A, Poon EG, Wald J, Feblowitz JC, Schnipper JL, Grant RW, Gandhi TK, Volk LA, Bloom A, Williams DH, Gardner K, Epstein M, Nelson L, Businger A, Li Q, Bates DW, Middleton B. Randomized controlled trial of health maintenance reminders provided directly to patients through an electronic PHR. J Gen Int Med 2012 Jan; 27(1):85-92. Epub 2011 Sep 9. http://www.ncbi.nlm.nih.gov/pubmed/21904945	Wright: This article is about reminders, which was not part of the revised focus for this report.
	{post 12/3/2010}Yamin CK, Emani S, Williams DH, Lipsitz SR, Karson AS, Wald JS, Bates DW. The digital divide in adoption and use of a personal health record. Arch Int Med 2011; 171(6):568-574. {This paper may be relevant since many studies are limited by selection bias in the study participants.}	Yamin: This article was too recent for our original search, but was captured by our search strategy in an update search, and is now included.
	Grant RW, Wald JS, Schnipper JL, Gandhi TK, Poon EG, Orav EJ, Williams DH, Volk LA, Middleton B. Practice-linked Online Personal Health Records for Type 2 Diabetes: A Randomized Controlled Trial. Arch Int Med 2008; 168(16):1776-82.	Grant 2008: This article is now included.
	Grant RW, Wald JS, Poon EG, Schnipper JL, Gandhi TK, Volk LA, Middleton B. Design and implementation of a web-based patient portal linked to an ambulatory care electronic health record: patient gateway for diabetes collaborative care. Diabetes Technol Ther. 2006; 8:576-86.	Grant 2006: Although our search did capture this article, it was marked as an exclude because it was descriptive qualitative and did not address barrier or facilitators to use.

Prompt	Comment	Response
(Continued) Are there any published or unpublished studies that we may have overlooked?	Wald JS. Variations in Patient Portal Adoption in Four Primary Care Practices. AMIA Annu Symp Proc 2010:837-41. {Supports the idea that it may be difficult to draw strong conclusions from practices/patients where adoption is weak; the implication for future VA work is to establish "level of adoption" metrics for comparability.} The Value of Personal Health Records. David C. Kaelber, MD, PhD, Sapna Shah, MS, Adam Vincent, MPP, Eric Pan MD, MSc, Julie M. Hook, MA, MPH, Doug Johnston, MTS, David W. Bates, MD, MSc, Blackford Middleton, MD, MPH, MSc. © 2008 by the Center for Information Technology Leadership (CITL). Published and distributed by the Healthcare Information and Management System Society (HIMSS). Requests for permission to reproduce any part of this work should be directed to: Ellen S. Rosenblatt, Manager of Operations Center for Information Technology Leadership Partners HealthCare System, Inc. One Constitution Center Information Systems Department, Second Floor West Charlestown, MA 02129 erosenblatt@partners.org. ISBN: 978-0-9800697-4-7	Wald 2010: This paper is a descriptive qualitative paper that was included in our search and that is now included in the new section on barriers and facilitators. Kaelber: This was already included, and is described in the "Patient Access and Efficiency/ Utilization."[42]
	Not including search terms such as 'personal health record', 'patient portal', 'secure email' and 'text messaging' may have reduced identification of potentially appropriate papers.	We will incorporate this suggestion into any future updated search, however for this report we rely on the original search and reference mining of included articles and the review by experts to identify potentially important missing studies. In the peer review process just completed, only three such articles (out of more than 60 already included) were identified, supporting a conclusion that the number of additional relevant studies now already identified is likely to be very small (<5%).
Please write additional suggestions or comments below. If applicable, please indicate the page and line numbers from the draft report.	There are some run-on sentences in the introduction, page 5.	We have edited the introduction.
	Recommend tabling key research question results and "GRADES".	We have included such a table in the Summary and Discussion section.
	From the automated email, I think there is a lot more research in the health behavior literature, Wayne Velicer, Vic Strecher, and many others have done this. Some has even extended to text messaging. Thus, I think that this section is not complete.	Because this was not the focus of the review, and based on the likelihood that our search did not adequately identify much of the literature in this area, we have removed this section from the report.
	Please correct all instances of My HealtheVet to be branded as shown here: "My Health***e***Vet"	This change has been incorporated.

Prompt	Comment	Response
(Continued) Please write additional suggestions or comments below. If applicable, please indicate the page and line numbers from the draft report.	It seems that there is logic to the order in which the GRADE of evidence is presented but it is unclear from the report what that logic is? It is clearly not higher to lower grades, but I wondered why? E.g. p 4	The order was based on the order of the outcomes in the key questions, and then within each outcome the evidence is sorted with GRADE going from high to low. A new table has been added for clarification.
	I find it very surprising that there is insufficient evidence to reach conclusions about the effect of patient access to their own medical record on their attitudes. Is this because most attitudinal studies were not examined since the scope was on hypothesis testing? Should that be qualified if that's the case?	In order to reach conclusions about satisfaction, we required a study to statistically test satisfaction, either between groups (with and without access to their own medical records) or across time (before and after access to their own medical records). Without these data, we can reach only limited conclusions. We started from the position that in order to reach cause-and-effect conclusions a hypothesis would need to be stated and then tested.
	I am finding that the comparison of use of PHR portal alone versus PHR portal WITH Secure Messaging has been useful in my own work. Instead the report compares SM with portal versus SM alone. Given that the model in the industry has evolved from PHR portal to portal WITH SM is there any way to reflect this in your analysis?	The original focus of the review was to evaluate secure messaging alone and then to evaluate the area of "patient access to medical records." In the patient access to medical records section, all of the tethered systems described in the 'Outcomes, Satisfaction and Adherence" section *and all but one* in the "Efficiency/Utilization" section include secure messaging as a component of their PHRs. In the one instance where this is not the case, it is specifically noted in the text.[30]
	Page 5: Dr. Nazi's office is Veterans and Consumers Health Informatics Office/Office of Informatics and Analytics	This change has been incorporated.
	P17. Missing period in para 2, could RVUs be defined?	This change has been incorporated.

Prompt	Comment	Response
(Continued) Please write additional suggestions or comments below. If applicable, please indicate the page and line numbers from the draft report	Consider further review and discussion of the interdependence of secure messaging and patient medical record access in the studies reviewed. Several of the intervention studies and most of the observational studies were in healthcare systems that intentionally tied together secure messaging and patient access to portions of the electronic medical record. Several of these interventions saw these two functions as interdependent for many patients, particularly for those needing self management support and collaborative care for chronic conditions. Parsing out the individual contribution of one of these activities may be less fruitful than seeing the value of the package.	As in the response to the comment above, the synthesis of "patient access to medical records" consisted of interventions that also included secure messaging, so the synthesis of the two interventions is already contained in the report. In addition, in the Summary and Discussion section, we have also discussed this point.
	Discuss results in the context of evolving definitions of patient medical electronic medical record access across the studies. For some of these studies, the record is a passive document viewed online by the patients. For others, the record is more interactive for patients and part of the ongoing care and communication tasks many patients face. In the latter case, the record can include secure patient provider messaging, medication refill functionality, and structured health risk assessment and feedback. Although current studies are not sufficient to determine the evidence behind the different approaches to patient access of the medical records, these differences may end up playing a role in outcomes as evidence evolves.	In order to inform this issue, we have included more detailed descriptions of the tethered systems described in the studies.
	Evaluation and discussion of equity in access to SM and patient access to medical records is missing. Secure messaging and patient access to the medical record should be seen as part of how we deliver care to all patients. Some historically vulnerable and underserved patient populations are less likely to use these services. As the VA and other similar organizations consider implementation of SM and patient access to the record, understanding and addressing these differences is essential for equitable care. I have provided a few references above to consider if the reviewers decided to encompass this domain.	We have included a new section entitled "Patient Access and Patient Characteristics" which reviews the evidence relevant to this comment.
	Page 15, second paragraph, third to last sentence. The randomized study of patients with diabetes referenced was done at the U of Washington, not Group Health (Ralston et al, Diabetes Care).	We thank the reviewer and author of the study for this observation, and have made the correction.

Prompt	Comment	Response
(Continued) Please write additional suggestions or comments below. If applicable, please indicate the page and line numbers from the draft report	Page 15, 3rd paragraph, in reference to Group Health randomized trial of essential hypertension. The review appears to erroneously imply that the control group did not have access to SM and the electronic medical record. All three study arms, including the usual care arm, had access to SM with PCP and other members of healthcare team and had access to similar portion of the electronic medical record. One intervention arm was given a home blood pressure cuff; the other intervention arm was given the blood pressure cuff and additionally access to pharmacist-based care management. All patients in the study were signed up and had access to the SM and electronic records. The strength of the study is showing how pharmacist care management over SM improves to BP control among patient who have access to SM and the services of the electronic record. May be particularly relevant to the VA's access efforts for mental health care.	We thank the reviewer and author for this clarification and have revised the description of the study and our conclusion.
	For Key Question #1, the Grant 2008 paper would justify adding to RESULTS (if authors agree): "There is ___ strength evidence that secure messaging (especially as part of a web-based management system) can improve medication decisions during a subsequent visit, reducing clinical inertia (Grant 2008 Arch Int Med).	We have added this conclusion (slightly modified) to the conclusion and given it a GRADE classification of "low" due to sparse data and concern about the generalizability of the intervention and practice settings.
	For Key Question #1, the association of secure messaging with many things (pt satisfaction, adherence, outcomes, etc.) is tempered by attitudes, workflow, service orientation, and factors beyond the tool itself. This is touched upon in the conclusion. Not sure if this "finding" can be considered given the report methodology, but I feel it's important because these factors are critical for understanding the current evidence and will likely impact future evidence as well. One paper that addresses practice (and other) factors are: Wald JS. Variations in Patient Portal Adoption in Four Primary Care Practices. AMIA Annu Symp Proc 2010:837-41.	We have now incorporated this reference in an expanded discussion of this issue.
	Not sure if this synthesis should include any high level comments about why the findings are largely indeterminate. Overall penetration of secure messaging and patient access to health records is still quite low, and given this, a paucity of rigorous data is not unexpected. Some of the findings may suffer from a ceiling effect…. Meaning that patients practicing greater health engagement with providers and in terms of self-management may be more likely to adopter new technology sooner, making it harder to demonstrate strong improvement.	We have incorporated these into the limitations.

Prompt	Comment	Response
(Continued) Please write additional suggestions or comments below. If applicable, please indicate the page and line numbers from the draft report	Comments on language: specific language and definitions could be helpful early on, with consistency throughout. Secure messaging, per VA-developed language, refers to secure email defined by online communication between patients and providers or healthcare team members. 'Messaging system' is less clear (e.g. page 14), and could include automated email, text or other technology such as interactive voice response (IVR). This review is focused on specific functionality delivered largely through patient portals and/or personal health record systems. Consider briefly defining functions early on; using either secure email or secure messaging, and avoid 'messaging' in other instances.	We have included definitions and have eliminated the section on automated email to avoid confusion.
	Comment on category of Efficiency/Utilization (page 16+): This grouping includes study findings across 3 types of measures: patient-level utilization of care or services delivered, provider-delivered care or workload measures, and patient-level characteristics or factors. The 3rd type of measure, characteristics of users and non-users, is important yet not a component of the category title. Impact on care utilization and provider workload should be distinct from one another.	We have now incorporated a new section on patient characteristics.
	Comment on Automatic Email Systems (page 19): there are several types of automatic messaging systems, including email notifications, text notification and others, such as IVR. Based on the search terms used, it appears the scoping was for the 1st type of notification only. If so, it would be valuable to describe the types of papers that were excluded. If not, there is some concern that the search terms used may have limited the studies identified.	This section has been deleted in this version.
	Comment on 'SM users': it would be helpful to clarify if a study examined patients who were enrolled or authenticated (identity-proofed) to use the PHR or secure email portal, or, whether actual use of SM was employed to identify the individuals. This is nuanced, but creates differences in study denominators.	This is an important distinction, however, most of the primary studies are not clear on this point.
	Comments on 'access to their own record': there are significant differences in the record content available for patients to view through a PHR. The VA offered access to medications and wellness reminders (at end of 2010); Kaiser and Group Health provided lab results and problem lists; few systems offered access to clinical notes. These distinctions should be described, even if there is insufficient evidence to discern the impact related to specific content or increasing level of health record access.	We have included more detailed descriptions of the tethered systems described in the studies.
	Page 14: 'web-based pharmacy group' – suggest modify to web-based system plus pharmacist	We have modified this description.
	Various pages: On-line can be one word: online; Diabetic patients should be patients with diabetes, patients with CHF, etc.	These changes have been incorporated throughout the text.

Prompt	Comment	Response
(Continued) Please write additional suggestions or comments below. If applicable, please indicate the page and line numbers from the draft report	Summary and Discussion (page 27): there appears to be a summary but no discussion.	We have now put the conclusions and GRADE information in a table and added text to the discussion.
	Limitation: all of these studies have relevance for the VA. Comments about fee-for-service or academic centers raise issues of external validity.	We have modified this text.
	Conclusion: studies showed patient satisfaction and reportedly improved communication with secure messaging alone. 'Web-based management program' could gain specificity with personal health record systems having access to online information and services… allowing patients to participate in their health and healthcare.	We have revised this section to include more information about this conclusion**.**
Please provide any recommen-dations on how this report can be revised to more directly address or assist implemen-tation needs.	Include relevant qualitative/descriptive research findings section/summary.	We have incorporated relevant qualitative descriptive studies about barriers and facilitators within the patient access section.
	Consider adding to the review a discussion of the evidence for coupling secure messaging and patient access to medical records, particularly for chronic conditions.	We have further emphasized these points.

APPENDIX E. EVIDENCE TABLES

Secure Messaging Evidence Table

Author, Year	Study Design; Sample; Study Date	HIT Intervention	Setting	Outcome Measures	Findings
Health Outcomes					
Simon, 2011[9]	RCT; N=208 patients; 04/09-10/09	Online depression care management using secure messaging through a patient website linked to the medical record.	Group Health Cooperative (9 primary care clinics)	Depression severity (Hopkins Symptom Checklist)	Intervention patients had lower depression severity at the end of the evaluation period and higher proportions experienced 50% or greater decreases in depression scores (55% vs. 41%, OR=1.8, 95% CI: 1.0-3.1)
Elkjaer, 2010[1]	RCT; N=333 patients with mild/moderate ulcerative colitis; Published 2010, uncertain enrollment period	Web-group receiving disease-specific education and self-treatment. Web-patients can contact Web-doctor through email/text message	2 hospitals each in Denmark & Ireland; No mention of EHR	Feasibility of the approach, its influence on patients' compliance, knowledge, quality of life (QoL), disease outcomes (relapse), safety and health care costs	Adherence to 4 weeks of acute treatment was increased by 31% in Denmark and 44% in Ireland compared to the control groups. In Denmark IBD knowledge and QoL were significantly improved in web patients. Median relapse duration was 18 days (95% CI 10 to 21) in the web versus 77 days (95% CI 46 to 108) in the control group. The number of acute and routine visits to the outpatient clinic was lower in the web than in the control group. No difference in the relapse frequency, hospitalization, surgery or adverse events was observed.
Zhou, 2010[2]	Observational; N= 35,423; 02/05-12/08	Pt access to EHR; Secure messaging	Kaiser Permanente	Health Outcomes (HEDIS measures)	Patients with diabetes who used secure messaging with providers had better HEDIS measures with respect to Hgb, BP, and LDL, and also had greater improvements in HEDIS measures
Harris, 2009[3]	Cohort; cohort=15,247 n=2,924 used messaging; 1/1/04-3/31/05	Secure messaging	Group Health Cooperative	High quality DM care Lower outpatient utilization	Use of messaging was associated with better glycemic control [a1c <7.0%, RR 1.36 (1.16-1.58)] Use of messaging was associated with higher rate of outpatient visits [1.39 (1.26-1.53)]
Ralston, 2009[6]	RCT; N=83; 08/02-05/04	Web-based care management	UW General Internal Medicine Clinic	Primary: HgbA1c change after 12 month intervention. Secondary: total plasma cholesterol an systolic and diastolic blood pressure	A1c levels declined significantly in the intervention group compared with the usual care group (change -0.7%, p=0.01). More participants in the intervention group than in the usual-care group had A1c<7% after 12 months (33vs 11%; p=0.03). At 12 months mean changes in systolic blood pressure, diastolic blood pressure, and total cholesterol were not significantly different between groups.
Tuil, 2007[4]	Clinical RCT; N=199 couples, 122 completed informed consent and were randomized to research (61) or control (61) group; 1/04-7/04	Internet-based health record that provides patients with general and personal information about treatment for infertility Control group: no access to system	University Medical Center Netherlands	Patient empowerment; patient satisfaction; meaning of infertility programs; social support; anxiety; depression	No significant differences were observed in patient empowerment, patient satisfaction, meaning of infertility problems, social support, anxiety, or depression. No adverse effects were noted in the use of internet-based health record

Author, Year	Study Design; Sample; Study Date	HIT Intervention	Setting	Outcome Measures	Findings
McMahon, 2005[5]	Open RCT; N=104; 10/01-04/03	Web-based Care Management (received notebook computer, glucose and blood pressure monitoring device and access to care management website)	VA Medical Center, Boston	HgbA1c, Systolic and Diastolic Blood Pressure.	There was a significant decrease in HgbA1c compared to baseline in both groups (P<0.001) at all serial points of measurement. (3,6,9,12 months). There was a greater decline in HgbA1c over time in the web-based care management group when compared to the education and usual care group (p<0.05). Those in the highest tertile of data uploads had significantly greater decline in HgbA1c than those in the lowest tertile (P<0.05). Hypertensive participants in the web-based care-management group had a significantly greater decline in SBP after 12 months (P<0.01). The frequency of website logins or data uploads was not a predictor for change in blood pressure.
Ross, 2004[8]	RCT ; N=107; 2002	A web interface giving patients access to the medical record, a guide to heart failure, and a messaging system	Academic Medical Center Existing EHR	Use, Physician and patient survey	Frequency of use was 0.4 hit-days per enrolled patient per month. Clinical notes and laboratory results were the most frequently viewed items. Electronic messaging supplemented rather than replaced telephone messages. Measures of self-efficacy were not statistically significantly different between groups. General adherence increased in the intervention groups.
Green, 2008[7]	RCT (3 groups); N=778; 06/05 – 12/07	Home blood pressure (BP) monitoring and secure patient Web site only vs. home BP monitoring and secure patient Web site plus pharmacist care management delivered through Web communication	Group Health Cooperative (10 medical centers)	Percentage of patients with controlled BP (<140/90) and changes in systolic and diastolic BP at 12 months	Patients in the home BP monitoring and Web site only group had a non-significant increase in the percentage of patients with controlled BP compared with usual care (36% vs. 31%, P=.21). Adding Web-based pharmacist care to home BP monitoring and the Web site significantly increased the percentage of patients with controlled BP (56%) compared with usual care (P .001) and home BP monitoring and Web site only (P .001). Compared with usual care, the patients who had baseline systolic BP ≥160 mm Hg and received home BP monitoring and the Web site plus pharmacist care had a greater net reduction in systolic and diastolic BP.
Patient Satisfaction					
Lin, 2005[10]	RCT; N=606; 03/03 – 08/03	Secure messaging portal through established EMR	Academic internal med clinic in Denver	Use, patient satisfaction	Portal group patients reported improved communication with the clinic and higher satisfaction with overall care
Leong, 2005[11]	RCT ; Providers=8 Patients=100; 12/01 – 07/02	Patients of intervention group used email to communicate with physicians	Academic medical clinic	Use, patient and provider satisfaction	Patient satisfaction significantly increased in the email group compared to the control group in areas of convenience and amount of time spent contacting the physician. Physician satisfaction increased for convenience and amount of time and volume of messages.
Liederman, 2005[14]	Retrospective case control; Case N=6 physicians, control N=9 physicians; 11/01-11/02	Relay Health System, a web based patient-provider communication system	Academic Medical Center Existing EHR	Use, Satisfaction	9% of intervention physicians' patients used the system. Fewer than 10% of the patients sent over 5 messages, 45% of patient sent a single message. Messages about medications, "other medical questions ," and general chronic symptoms comprised half of all messages. Half of all messages were responded to in four hours, 86% within 16 hours. Telephone call volume was 18.2% less for intervention physicians than control. Patients were in general satisfied and found messaging easy to use. Providers were marginally satisfied, but found it easy to use and were neutral on the effect on workflow.

Author, Year	Study Design; Sample; Study Date	HIT Intervention	Setting	Outcome Measures	Findings
Tuil, 2007[4]	Clinical RCT; N=199 couples, 122 completed informed consent and were randomized to research (61) or control (61) group; 01/04-07/04	Internet-based health record that provides patients with general and personal information about treatment for infertility Control group: no access to system	University Medical Center Netherlands	Patient empowerment; patient satisfaction; meaning of infertility programs; social support; anxiety; depression	No significant differences were observed in patient empowerment, patient satisfaction, meaning of infertility problems, social support, anxiety, or depression. No adverse effects were noted in the use of internet-based health record
Ross, 2004[8]	RCT; N=107 Patients; 2002	A web interface giving patients access to the medical record, a guide to heart failure, and a messaging system	Academic Medical Center Existing EHR	Use, Physician and patient survey	Frequency of use was 0.4 hit-days per enrolled patient per month. Clinical notes and laboratory results were the most frequently viewed items. Electronic messaging supplemented rather than replaced telephone messages. Measures of self-efficacy were not statistically significantly different between groups. General adherence increased in the intervention groups.
Liederman, 2003[13]	Observational; N=238 Patients N=8 Clinicians; 2001-2002	Relay Health System, a web based patient-provider communication system	Academic Medical Center Existing EHR	Use, Physician and patient surveys	37% of patients responded to the survey. 89% of patients found the system easy to use. 50% of patients used the system once or twice. 6 of 8 clinicians were satisfied or very satisfied with the system.
Houston, 2004[12]	Observational Internet-based survey; N=1,881; 05/01-10/01	e-mail to communicate with physicians	Survey link from website of 1) Intelihealth (health media company) and 2) CareGroup Healthcare System (Harvard-affiliated integrated health delivery network)	Use, clinical topics discussed through e-mail, perceived benefits, overall satisfaction	16.5% (of 1881) individuals reported using electronic mail to communicate with their physicians. Most frequent topics were results of lab testing (85%) and prescription renewals (85%). 21% of users inappropriately e-mailed about urgent or sensitive issues (suicidality, chest pain). 95% perceived e-mail to be more efficient than telephone. 82% of respondents were satisfied with the e-mail communication.
Adherence					
Muller, 2009[15]	Randomized cohort ; N=2100 randomized to email, letter, or usual care; 2007-2008	Secure email reminder system for colorectal cancer screening	Kaiser Permanente	Completion of CRC screening	CRC screening rates for patients receiving usual care (7.8%), email (22.7%), letter (23.6%) $p<0.0005$ usual care vs. letter $p<0.0005$ usual care vs. email $p=7.11$ letter vs. email
Ross, 2004[8]	RCT; N=107 Patients; 2002	A web interface giving patients access to the medical record, a guide to heart failure, and a messaging system	Academic Medical Center Existing EHR	Use, Physician and patient survey	Frequency of use was 0.4 hit-days per enrolled patient per month. Clinical notes and laboratory results were the most frequently viewed items. Electronic messaging supplemented rather than replaced telephone messages. Measures of self-efficacy were not statistically significantly different between groups. General adherence increased in the intervention groups.

Author, Year	Study Design; Sample; Study Date	HIT Intervention	Setting	Outcome Measures	Findings
Efficiency /Utilization					
Elkjaer, 2010[1]	RCT; N=333 patients with mild/ moderate ulcerative colitis; Published 2010, uncertain enrollment period	Web-group receiving disease-specific education and self-treatment. Web-patients can contact Web-doctor through email/text message	2 hospitals each in Denmark & Ireland; No mention of EHR	Feasibility of the approach, its influence on patients' compliance, knowledge, quality of life (QoL), disease outcomes (relapse), safety and health care costs	Adherence to 4 weeks of acute treatment was increased by 31% in Denmark and 44% in Ireland compared to the control groups. In Denmark IBD knowledge and QoL were significantly improved in web patients. Median relapse duration was 18 days (95% CI 10 to 21) in the web versus 77 days (95% CI 46 to 108) in the control group. The number of acute and routine visits to the outpatient clinic was lower in the web than in the control group. No difference in the relapse frequency, hospitalization, surgery or adverse events was observed.
Weppner, 2010[16]	Retrospective cohort study; N = 6,185 enrollees > 64 years old with diabetes; 2003-2007	Shared medical record: secure messaging, medication refills, appointment requests, view test results, after-visit summaries, medical problem lists	Group Health Cooperative; probable EHR	Patients' use of shared medical record (SMR)	32.2% of enrollees used the SMR; median rate was 1.02 user-days/month. Numbers of users and rate of use increased over time. (Likelihood of initial SMR use was associated with assigned PCP's use of secure messaging.)
Santana, 2010[17]	Cross-sectional survey; N=7,022; 04/07-05/07	Use of the internet by patients to communicate with providers	European population (not specific)	Use, patient surveys, phone interviews, attitudes	In 2007, approximately 1.8% of population had used internet to order a rx, 3.2% to schedule an appt, and 2.5% to ask a health question. Among those using the internet for health purposes, more than 4 out of 10 considered it important when choosing a doctor
Harris, 2009[3]	Cross-sectional analysis; diabetes N=15,247; total N=2,924 used messaging; 1/1/04-3/31/05	Secure messaging	Group Health Cooperative	High quality DM care Lower outpatient utilization	Use of messaging was associated with better glycemic control [a1c <7.0%, RR 1.36 (1.16-1.58)] Use of messaging was associated with higher rate of outpatient visits [1.39 (1.26-1.53)]
Ralston, 2009[18]	Cross-sectional survey; N=4,059 pts over age 65 N=181 physicians; 01/01/04-03/31/05	Secure Messaging	Group Health Cooperative	Characteristics of users of secure messaging	Higher use rates associated with: Females [OR 1.15 (1.10-1.19)] greater morbidity [OR 5.64 (5.07-6.28)] PCP use with other patients [OR 1.94 (1.67-2.26)] Lower use associated with: Age over 65 [0.65 (0.59-0.71)] Medicaid vs. commercial insurance [OR 0.81 (0.68-0.96)]
Brooks, 2006[19]	Cross-sectional survey; N=10,253 primary care physicians, 3,954 ambulatory clinical specialists; 03/05-05/05	Use of email by providers to communicate with patients	Ambulatory primary care and specialists in Florida	Use, provider surveys	Of 4,203 physicians completing the survey, 16.6% had used email to communicate with patients. Only 6.7% adhered to at least half of the 13 selected guidelines for email communication

Author, Year	Study Design; Sample; Study Date	HIT Intervention	Setting	Outcome Measures	Findings
Bergmo, 2005[20]	RCT; N=200; 2002-2003	Secure web messaging system	Primary care clinic in Norway	Use, efficiency	Forty-six percent of pts given access to messaging system used the online communication at least once. The reduction in office visits over time was greater for the intervention group than for the control group (p=0.034).
Ketteridge, 2005[21]	Retrospective Cohort; N=306 Cohort N=352 Control; 07/03-06/04	Informational sheet was given to patients listing surgeons email address as first option. Participants were also instructed that e-mail was the preferred communication method.	Single Surgical Practice at University of Sydney Endocrine Surgical Unit	E-mail utilization (characterization of user)	In the study group 50 of 306 patients (16%) utilized email communication, compared to 10 of 352 (3%) in the control group (P=0.0001). Email users represented a younger population, mean age 46.2 vs. 54.6 years (P=0.0004) in the study group and mean age 44.2 vs. 54.6 in the control group (P=0.03) . No difference in sex distribution. In the study group, 101 emails were sent by 50 patients and a majority of patients sent only one message (56%) and focused on only one issue. Most common reason for sending an email was to obtain general clinical information (n=123, 62%).
Liederman, 2005[22]	Controlled before and after; N is unclear, 2 clinics; 11/01-11/02	Relay Health System, a web based patient-provider communication system	Academic Medical Center Existing EHR	Use, Physician Productivity	9% of intervention physicians' patients used the system. Intervention physicians averaged 11% more visits per day than control physicians (25.5 vs. 22.9). Intervention physicians averaged 10% more RVUs per day. RVUs per visit were not different between intervention and control.
Liederman, 2005[14]	Retrospective case control; Case N=6 physicians, control N=9 physicians; 11/01-11/02	Relay Health System, a web based patient-provider communication system	Academic Medical Center Existing EHR	Use, Satisfaction	9% of intervention physicians' patients used the system. Fewer than 10% of the patients sent over 5 messages, 45% of patient sent a single message. Messages about medications, "other medical questions," and general chronic symptoms comprised half of all messages. Half of all messages were responded to in four hours, 86% within 16 hours. Telephone call volume was 18.2% less for intervention physicians than control. Patients were in general satisfied and found messaging easy to use. Providers were marginally satisfied, but found it easy to use and were neutral on the effect on workflow.
Chen, 2009[23]	Retrospective Observational Study; N=225,000; Baseline year: 2004 Comparison Year: 2007	Implementation of KP HealthConnect in primary care completed November 2004. Implementation of KP HealthConnect in specialty care completed June 2005. Patient-provider secure messaging function available Sept 2005	Kaiser Hawaii – integrated health care delivery system	Utilization of office visits, telephone visits, secure messaging and ED/Urgent Care	Total office visits decreased 26.2% between 2004 and 2007 (p<0.001). Total scheduled telephone visits increased nine-fold. Increase in Secure messages between 2005 and 2007 was statistically significant (p<0.001). Rate of urgent care (19%, p< 0.001) and ED visits (11%, p<0.001) increased between 2004 and 2007
Ralston, 2009[6]	RCT; N=83; 08/02-05/04	Web-based care management	UW General Internal Medicine Clinic	Primary: HgbA1c change after 12 month intervention. Secondary: total plasma cholesterol and systolic and diastolic blood pressure	A1c levels declined significantly in the intervention group compared with the usual care group (change -0.7%, p=0.01). More participants in the intervention group than in the usual-care group had A1c<7% after 12 months (33vs 11%; p=0.03). At 12 months mean changes in systolic blood pressure, diastolic blood pressure, and total cholesterol were not significantly different between groups.

Author, Year	Study Design; Sample; Study Date	HIT Intervention	Setting	Outcome Measures	Findings
Zhou, 2007[24]	Retrospective case-control pre-post analysis; Cohort N=4,686, control N=3,201; 09/02-11/05	Patient access to secure messaging	Kaiser Permanente Northwest (KPNW)	Office visit rate and telephone contact rate.	In the cohort study annual adult primary care visit rates decreased by 9.7% (2.47-> 2.24 office visits per member/year P<0.01). In the matched control study annual adult primary care visit rates decreased by 10.3% (P<0.001). Annual primary care telephone contact rate increased by 29.9% vs. 16.2% on the study group. (P<0.1)
Tang, 2006[25]	Random sample survey; N=120 messages; 01/01/05-06/30/05	Analyzed electronic patient-physician messages	Palo Alto Medical Foundation	Content Analysis of Secure Patient Messages.	22% of clinical messages sent to physicians contained sufficient patient history taking data and decision-making components to warrant reimbursement according to authors eVisit criteria.
Katz, 2004[26]	RCT; N=132 Physicians; 2001-2002	Patients of intervention physicians were encouraged to use a web based tool to communicate with staff	Academic Medical Center No existing EHR	Use of web messaging, Physician and patient survey of attitudes	In the intervention group, 1,038 patients registered and 2,238 messages were sent. 42% of patients sent no messages, 22% of patients sent >3 messages. Over 20% were appointment-related, 15% were referral requests, 12% were prescription related. During the 40 week study period, the number of patient emails and telephone calls were not affected by the intervention, being 2 fold and 10 fold greater respectively. Intervention physicians were more positive about web communication then control physicians.
Ross, 2004[8]	RCT; N=107 Patients; 2002	A web interface giving patients access to the medical record, a guide to heart failure, and a messaging system	Academic Medical Center Existing EHR	Use, Physician and patient survey	Frequency of use was 0.4 hit-days per enrolled patient per month. Clinical notes and laboratory results were the most frequently viewed items. Electronic messaging supplemented rather than replaced telephone messages. Measures of self-efficacy were not statistically significantly different between groups. General adherence increased in the intervention groups.
Liederman, 2003[13]	Observational; N=238 Patients N=8 Clinicians; 2001-2002	Relay Health System, a web based patient-provider communication system	Academic Medical Center Existing EHR	Use, Physician and patient surveys	37% of patients responded to the survey. 89% of patient found the system easy to use. 50% of patients used the system once or twice. 6 of 8 clinicians were satisfied or very satisfied with the system.
Green, 2008[7]	RCT (3 groups); N=778; 06/05 – 12/07	Home blood pressure (BP) monitoring and secure patient Web site only vs. home BP monitoring and secure patient Web site plus pharmacist care management delivered through Web communication	Group Health Cooperative (10 medical centers)	Percentage of patients with controlled BP (<140/90) and changes in systolic and diastolic BP at 12 months	Patients in the home BP monitoring and Web site only group had a non-significant increase in the percentage of patients with controlled BP compared with usual care (36% vs. 31%, P=.21). Adding Web-based pharmacist care to home BP monitoring and the Web site significantly increased the percentage of patients with controlled BP (56%) compared with usual care (P .001) and home BP monitoring and Web site only (P .001). Compared with usual care, the patients who had baseline systolic BP ≥160 mm Hg and received home BP monitoring and the Web site plus pharmacist care had a greater net reduction in systolic and diastolic BP.

Patient Access Evidence Tables

Author, Year (ID)	Study Design; Sample; Study Date	HIT Intervention	Setting	Outcome Measures	Findings
Health Outcomes, Satisfaction, and Adherence					
McCarrier, 2009 [28]	RCT; N=77 pts; 12 months	Usual care plus access to a nurse practitioner case manager and the web-based disease management module.	University of Washington Diabetes Care Center	Hemoglobin A1c, Psychosocial self-efficacy	A1c values did not differ significantly after a year of follow-up. There was an increase in psychosocial self-efficacy (difference of 0.3, 95% CI: 0.01-0.59, p=0.04).
Ralston, 2009[6]	RCT; N=83 pts; 08/02-05/04	Web-Based diabetes care management for diabetes as part of an intervention based in the chronic care model and included a case manager for training, review of blood source readings, communication with patients, adjustment of diabetes medications, and discussion with the patients' PCP.	University of Washington General Internal Medicine Clinic, 83 patients enrolled with Hsb A1c > 7.0% who spoke English and could use the computer with the internet	Hemoglobin A1c, Use of service	Compared to usual care, intervention with patients had a hemoglobin A1c < 7.0% at 12 months (33% vs. 11%, p=0.03). There was no difference between groups in blood pressure control or lipid levels. There was no difference between groups in the numbers of outpatient visits, primary care visits, specialty physician visits, or inpatient days.
Grant, 2008[29]	RCT; N=11 primary care practices (126 intervention pts, 118 control pts); 09/05-03/07	Intervention practices gave patients access to a diabetes mellitus-specific personal health record with modules for medication review, clinical data, and care plans.	Partners HealthCare	Hemoglobin A1c, blood pressure, LDL-C	After one year of follow-up, there were no differences in A1c levels, blood pressure, or LDL-C levels between groups.
Tuil, 2007[4]	Clinical RCT; N=199 couples, 122 completed informed consent and were randomized to research (61) or control (61) group; 1/04-7/04	Internet-based health record that provides patients with general and personal information about treatment for infertility Control group: no access to system	University Medical Center Netherlands	Patient empowerment; patient satisfaction; meaning of infertility programs; social support; anxiety; depression	No significant differences were observed in patient empowerment, patient satisfaction, meaning of infertility problems, social support, anxiety, or depression. No adverse effects were noted in the use of internet-based health record
Ross, 2004[8]	RCT; N=107 patients; Dates not specified but around 2002	Pt access to records; secure messaging	Academic subspecialty clinic in Colorado	Pt/provider communication, health outcomes, pt satisfaction, adherence	The intervention group was not found to be superior in self-efficacy but was superior in general adherence. There was a trend toward better satisfaction with pt/provider communication.

Author, Year (ID)	Study Design; Sample; Study Date	HIT Intervention	Setting	Outcome Measures	Findings
Green, 2008[7]	RCT (3 groups); N=778; 06/05 – 12/07	Home blood pressure (BP) monitoring and secure patient Web site only vs. home BP monitoring and secure patient Web site plus pharmacist care management delivered through Web communication	Group Health Cooperative (10 medical centers)	Percentage of patients with controlled BP (<140/90) and changes in systolic and diastolic BP at 12 months	Patients in the home BP monitoring and Web site only group had a non-significant increase in the percentage of patients with controlled BP compared with usual care (36% vs. 31%, P=.21). Adding Web-based pharmacist care to home BP monitoring and the Web site significantly increased the percentage of patients with controlled BP (56%) compared with usual care (P .001) and home BP monitoring and Web site only (P .001). Compared with usual care, the patients who had baseline systolic BP ≥160 mm Hg and received home BP monitoring and the Web site plus pharmacist care had a greater net reduction in systolic and diastolic BP.
Ralston, 2007[33]	Cross sectional survey; N=2,002 patients; 09/02-12/05	My Group Health patient website, linked to EpicCare	Group Health Cooperative 750,000 patients have access, 2000 patients invited for survey	Use, Satisfaction	Over 3 years, the number of patients receiving ID verification to use My Group Health increased from 3% to 25%. Use increased over time. The most commonly used services were test results, medication refill requests, after visit summaries, and patient-provider clinical messaging.
Efficiency/Utilization					
Wald, 2010[27]	RCT; N=3,979 participants; 2005-2007	eJournal, a patient completed pre-visits electronic journal submitted to providers prior to an office visit. This eJournal was one component of Patient Gateway, which had 21,533 accounts registered.	Primary and specialty practices at Brigham & Women's hospital	Use, Patient and provider satisfaction	About 3% of eligible patients consented to the study, of which about 50% were invited to submit a journal, of which between 64% to 78% opened the journal, and of these 97% of patients edited an existing entry. eJournal invitations for medications, allergies, and diabetes history were more likely to get completed and be viewed by patients and providers as being useful to the visit than were eJournal invitations for personal and family health history and health maintenance items.
Ralston, 2009[6]	RCT; N=83 pts; 08/02-05/04	Web-Based diabetes care management for diabetes as part of an intervention based in the chronic care model and included a case manager for training, review of blood source readings, communication with patients, adjustment of diabetes medications, and discussion with the patients PCP.	University of Washington General Internal Medicine Clinic, 83 patient enrolled with Hsb A1c > 7.0% who spoke English and could use the computer with the internet	Hemoglobin A1c, Use of service	Compared to usual care, intervention with patients had a hemoglobin A1c < 7.0% at 12 months (33% vs. 11%, p=0.03). There was no difference between groups in blood pressure control or lipid levels. There was no difference between groups in the numbers of outpatient visits, primary care visits, specialty physician visits, or inpatient days.
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Author, Year (ID)	Study Design; Sample; Study Date	HIT Intervention	Setting	Outcome Measures	Findings
Weppner, 2010[16]	Retrospective cohort study; N = 6,185 enrollees > 64 years old with diabetes; 2003-2007	Shared medical record: secure messaging, medication refills, appointment requests, view test results, after-visit summaries, medical problem lists	Group Health Cooperative; probable EHR	Patients' use of shared medical record (SMR)	32.2% of enrollees used the SMR; median rate was 1.02 user-days/ month. Numbers of users and rate of use increased over time. (Likelihood of initial SMR use was associated with assigned PCP's use of secure messaging.)
Ralston, 2007[33]	Cross sectional survey; N=2,002 patients; 09/02-12/05	My Group Health patient website, linked to EpicCare	Group Health Cooperative 750,000 patients have access, 2000 patients invited for survey	Use, Satisfaction	Over 3 years, the number of patients receiving ID verification to use My Group Health increased from 3% to 25%. Use increased over time. The most commonly used services were test results, medication refill requests, after visit summaries, and patient-provider clinical messaging.
Burke, 2010[30]	Cohort; N=272; 2006-2009	I-Rounds, a web-based electronic health record, to which patients had access to the history and physical report, patient care instructions, and on imaging data from surgery.	Miami Children's Hospital, Congenital Cardiac Disease	Use	93% of the patients or families used the system. Access was more common when the patients were in-hospital than out-of-hospital imaging data were most commonly viewed.
Hassol, 2004[34]	Descriptive quantitative; N=1421; Study dates not mentioned but probably around 2001-2004	Pt access to records; web messaging	Geisinger Health System, HMO in Pennsylvania	Use, patient attitudes, pt/provider communication; patient satisfaction; barriers; Pt's and providers surveyed	Majority of users indicated that the system was easy to use. Minority of users was concerned about the confidentiality of their information. Patients preferred e-mail communication for requesting rx renewals, obtaining general medical information. Physicians were more likely to prefer telephone communication and less likely to prefer e-mail communication.
Kaelber, 2008[42]	Descriptive Cost-benefit analysis	Value of Personal health record: 1. Provider tethered 2. Payer tethered 3. Third party PHR 4. interoperable	n/a	Net Value	All PHRs have an initial net negative value. After 10 years, steady-state annual net value ranging from $13 billion to $29 billion. Interoperable PHRs provide the most value, followed by third-party, and payer tethered. Provider tethered show a consistent negative net value.
Green, 2008[7]	RCT (3 groups); N=778; 06/05 – 12/07	Home blood pressure (BP) monitoring and secure patient Web site only vs. home BP monitoring and secure patient Web site plus pharmacist care management delivered through Web communication	Group Health Cooperative (10 medical centers)	Percentage of patients with controlled BP (<140/90) and changes in systolic and diastolic BP at 12 months	Patients in the home BP monitoring and Web site only group had a non-significant increase in the percentage of patients with controlled BP compared with usual care (36% vs. 31%, P=.21). Adding Web-based pharmacist care to home BP monitoring and the Web site significantly increased the percentage of patients with controlled BP (56%) compared with usual care (P .001) and home BP monitoring and Web site only (P .001). Compared with usual care, the patients who had baseline systolic BP ≥160 mm Hg and received home BP monitoring and the Web site plus pharmacist care had a greater net reduction in systolic and diastolic BP.

Author, Year (ID)	Study Design; Sample; Study Date	HIT Intervention	Setting	Outcome Measures	Findings
Attitudes					
Wald, 2010[27]	RCT; N=3,979 participants; 2005-2007	eJournal, a patient completed pre-visits electronic journal submitted to providers prior to an office visit. This eJournal was one component of Patient Gateway, which had 21,533 accounts registered.	Primary and specialty practices at Brigham & Women's hospital	Use, Patient and provider satisfaction	About 3% of eligible patients consented to the study, of which about 50% were invited to submit a journal, of which between 64% to 78% opened the journal, and of these 97% of patients edited an existing entry. eJournal invitations for medications, allergies, and diabetes history were more likely to get completed and be viewed by patients and providers as being useful to the visit than were eJournal invitations for personal and family health history and health maintenance items.
Cho, 2010[32]	Cross sectional; N=201; Date not stated, prior to 2010	My Health*e*Vet	Durham, VA Veterans with diabetes and Hgb A1c > 8.0%	Use, Access, Interest	Of 201 patient surveys completed (53% response rate) 59% reported having internet access at home, being "moderately" comfortable with internet tasks, 18% had heard of My Health*e*Vet, and 9% had used it. 41% of patients were "very interested" in using it.
Earnest, 2004[31]	RCT; N=107 patients N=8 physicians; 01/02-12/02	Pt access to records; secure messaging	Academic subspecialty clinic in Colorado	Pt and physician attitudes via survey and phone interviews; Efficiency	Patients were significantly more likely than physicians to anticipate benefits of SPPARO and less likely to anticipate problems. Attitudes of subjects did not diverge from controls after the intervention period. In post trial interviews, physicians and staff reported no change in their workload and no adverse consequences. All of the physicians ultimately supported the concept of giving patients online access to their clinical notes and test results.
Volk, 2005[35]	Cross sectional survey; N=460; 2003	Patient Gateway, a secure web portal	Partners HealthCare 2000 patients	Patient prescriptions	23% of patients returned the survey. 70% of users of the web portal reported overall satisfaction as "good" or better. Respondents were about as evenly split on whether or not using the web portal improved communication with providers. The most frequently rated valuable functions were the ability to renew prescriptions, ask an administrative question, and obtain referral approvals.
Eklund, 2004[36]	Descriptive qualitative; N=100; 1999-2001	Pt access to EHR, secure messaging	Community surgical clinics	Use, barriers; Pts and providers surveyed	On average, the users accessed the system less than 5 times during the trial period. 82% of the users had not been at all worried about security risks during the trial, while 15% expressed "some concern".
Hassol, 2004[34]	Descriptive quantitative; N=1421; Study dates not mentioned but probably around 2001-2004	Pt access to records; web messaging	Geisinger Health System, HMO in Pennsylvania	Use, patient attitudes, pt/provider communication; patient satisfaction; barriers; Pt's and providers surveyed	Majority of users indicated that the system was easy to use. Minority of users was concerned about the confidentiality of their information. Patients preferred e-mail communication for requesting rx renewals, obtaining general medical information. Physicians were more likely to prefer telephone communication and less likely to prefer e-mail communication.
Schnipper, 2008[45]	Descriptive; Sample N/A; Not specified	Web based patient portal linked to Ambulatory EMR (Diabetes)	Multi-hospital health care network in US	None	Description of design, implementation plan, and evaluation plan. Plan to assess the impact with a clinic RCT among 14 primary care practices in the health care system

Author, Year (ID)	Study Design; Sample; Study Date	HIT Intervention	Setting	Outcome Measures	Findings
Pai, 2005[41]	Cross-sectional survey; Convenience sample of 41 men and 18 sig others (SS). Focus group 11 men and 5 SS; 2002	Patient and significant other access to web based EHR Questionnaire of health information (HI) needs of prostate cancer patients; questionnaire and focus group of web-based EMR at meet HI needs	Prostate cancer support group Victoria, BC	Interest in access to EHR	75% of men desired the ability to access their health records through means other than by meeting with their health care provider, with the internet ranking as the most desired method. 70% of significant others desired the ability to access their men's health record online.
Honeyman, 2005[38]	Semi-structured interview; N=109; 2003	Patient access to their own electronic medical record	Group Practice (community) in London, UK	Accuracy Data Security Dr-Pt relationship Internet Access to EMR	82% of respondents were interested in viewing their medical record. 75% felt that access to their record would improve their relationship with their doctor. 80% were not concerned about security. 75% felt their record was accurate.
Leonard, 2004[39]	Questionnaire of physicians and patients (lung-transplant); N=20 physicians, N=30 patients; 2001	Patient & Physician input into design and content of EPR	University Health Network in Toronto, Canada	Physician and patient's perspective on who should have access to info.	Almost two-thirds of patients (63%) had seen some portion of their medical record (most commonly blood work or X-ray results) and a similar percentage believed a personal medical record would help them manage their personal health care. All physicians felt that patients should receive self-care instructions, yet only half agreed to receiving discharge summaries (10 out of 20) and a minority felt that the patients should be able to receive access to operative notes (5 out of 20, or 25%).
Pyper, 2004[40]	Questionnaire and focus groups; N=100 for questionnaire and 7 for focus group; Not specified	Patient experience when assessing their own online patient records	Urban practice in Oxford, UK serving 10,300 patients	Ease of use; confidentiality; security; expectations of content; receiving new information and bad news	Majority of patients found viewing their record useful and understood most of the content, although medical terms and abbreviations required explanation. Patients were concerned about security and confidentiality, including potential exploitation of records. They wanted the facility to give informed consent regarding access and use of data. Many found errors, although most were not medically significant. Many expected more detail and more information. Patients wanted to add personal information.
Dorr, 2003[37]	Hypothesis testing; N=150 physicians; Dates not specified	Pt access to records	"email using" physicians	Physicians attitudes via surveys and phone interviews	Most felt the medication list, normal studies, prescription refills, appointments, and referrals should be provided to the patients ($p<.05$). However, they felt progress notes, abnormal labs, and care over the internet should not be provided.
Patient Characteristics					
Lyles, 2012[46]	Cross sectional survey and medical record review; N= 718 patients with diabetes for survey, N=625 pts with diabetes for record review; 09/09	Patient portal access	5 Group Health Cooperative medical clinics in western Washington	SMR use	Whites (compared to Blacks, Asians, or others), younger patients, and those with higher education and income were more likely to be users of the patient portal.

Author, Year (ID)	Study Design; Sample; Study Date	HIT Intervention	Setting	Outcome Measures	Findings
Yamin, 2011[49]	Cross sectional analysis of prtal data; N= 75,056; 01/02-09/09	Patient Gateway; an online tethered personal health record	Partners HealthCare	Adoption/ registration	43% were "adopters," with lower rates among racial/ethnic minorities compared to whites and higher rates among patients with selected comorbidities (asthma, CHF, diabetes, hypertension) compared to patients healthier patients.
Sarkar, 2010[48]	Cross sectional survey and KP.org data; N= 14,102 pts English speakers with diabetes; 01/06-12/06	KP.org portal, a tethered personal health record	Kaiser Permanente Northern California	use	Only 40% registered for KP.org and 27% signed on one or more times. African Americans, Latinos, and Filipinos were more than twice as likely not to sign on to KP.org when compared to whites. Those with lower self-reported health literacy were 1.7 times less likely to sign on the KP.org.
Roblin, 2009[47]	Cohort study; N=1,777 pts; 10/05-11/07	KP.org, a tethered personal health record	Kaiser Permanente Georgia	Time to registration	35% of participants registered during the study period and were more likely to be white than African American (42 vs. 30%, $p<0.01$), to have diabetes or elevated lipids compared to low risk adults (36 and 38% vs. 30%, $p=0.01$), and to have a higher levels of education.
Non-Tethered					
Montelius, 2008[53]	Cross sectional survey; N=1716; 2007	"My Dispensed Medications" a web-based register of dispensed medications accessible to patients.	Sweden N=1,000,000 are on the register, during the study 7,860 accessed the site and were offered the survey	Satisfaction	1,716 completed the survey (response rate = 22%). Patient ratings were high for usefulness and design of website. Getting control of prescriptions and getting an "overview" of prescriptions was listed by 70% of patients as their reasons for accessing the site.
Urowitz, 2008[54]	Cross sectional survey; N=83; Date not stated but prior to 2008	The concept of patient accessible electronic health records. All Chief Executive Officers of Canadian public and acute care hospitals N=213	Canada This is not tethered to any electronic health record	Perceptions about providing patient access to electronic health records	The response rate to the survey was 39%. About half of responding hospitals already had some form of electronic health record, but almost no hospitals used it as the sole method for recording patient information. Financial barriers were the most commonly identified barrier to providing patient access. Patient computer literacy and physician buy-in were also considered important barriers.
Bernheim, 2006[55]	Questionnaire of patients who use device; N=536 patients; 392 (73%) responded; One year period, date not specified	CardioCard. Credit card-sized electronic patient record	University Hospital in Switzerland	Usefulness Technical concerns Data security	73% found the card to be useful. Lack of hardware or insufficient computer knowledge was factors in non-use. Privacy was a concern.
Kim, 2005[56]	Descriptive quantitative; N=24; 12/04 – 03/05	Pt access to records	Low income housing facility	Use, patient attitudes, patient satisfaction, barriers; Pts surveyed	Among 24 residents, 50% participated in the survey. Only 16.7% were able to fill in the health records by themselves. 83% agreed that they have paid more attention to their health conditions and care using PHIMS. Ninety two percent answered that they are satisfied with the personal health record system in general.