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The proposed Stage II Meaningful Use (MU) objectives, would require healthcare organizations to offer patients the ability to access their health related information through a web-based portal. However, MU criteria is just one of the underlying reasons patient portals will become an essential component of thriving healthcare organizations. As the Internet technology permanently altered the way in which we shop, bank, communicate and distribute information, these capabilities have also entered healthcare arena with the promise of improving patient-provider communications, patient involvement in their health care which could potentially lead to improved healthcare outcomes. This paper addresses the role of patient portals in meeting the MU objectives, evaluates interest and factors influencing healthcare consumers' portal adoption, and identifies barriers to adoption of portal technologies by healthcare organizations.

Headings:

> Patient Portal
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> Personal Health Records
>
> Usability
>
> Adoption
>
> Meaningful Use
>
> Patient-Provider Interactions

INTEGRATED HEALTH INFORMATION PATIENT PORTALS:
A GATEWAY TO IMPROVED PATIENT-PROVIDER INTERACTIONS

by
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I. INTRODUCTION

In recent years, much attention in the healthcare community has been focused on the emergence of new Electronic Health Record (EHR) standards, associated HIPAA privacy and security requirements, as well as Meaningful Use (MU) rules and incentives offered to providers and medical centers who invest in healthcare information technology. Transforming the entire healthcare system to adopt fully functional EHR is a complex and cost prohibitive undertaking. To aid in the transition, in February 2009 the President signed into law the American Recovery and Reinvestment Act (ARRA). The ARRA includes the Health Information Technology for Economic and Clinical Health (HITECH) Act, which adds $19.2 billion in funding for Health Information Technology (HIT) infrastructure and adoption. Incentives are offered to physicians and hospitals who implement certified EHR technology and meet the meaningful use criteria[1]. Due to the government incentive program offered through the Centers for Medicare and Medicaid Services (CMS), increasing number of physicians and healthcare organizations are now rapidly adopting EHR technology, the rate of the hospitals who adopted EHR has more than doubled from 16% in 2009 to 35% in 2011[2]; the most recent survey among all healthcare organizations reports current adoption rate of 45.6%[3].

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[1] Source: http://www.cms.gov/ehrincentiveprograms
[2] HHS.gov Press Release, Feb 2012 http://www.hhs.gov/news/press/2012pres/02/20120217a.html
[3] Source: http://www.skainfo.com/health_care_market_reports/EMR_Electronic_Medical_Records.pdf

While adoption of EHR technology is on the rise, until recently relatively little emphasis has been placed on making the information contained within EHRs easily accessible to the health care consumer (Nazi, 2010). EHRs contain patient related health information that is managed by the healthcare provider, but often the availability of this information has been limited to a patient requesting a copy of their medical record. Increasing utilization of EHRs and the growth of Internet based technologies provide a unique opportunity for physicians and healthcare organizations to aid the healthcare consumer in becoming better informed and ultimately more engaged in their care. Implementation of Web based patient portals offer a solution, providing patients with secure and easy access to information contained in their official medical record, along with a wide range of other potential benefits, which will be described later. Furthermore, the ability to present this information in an easy to understand format, adding customized patient-specific educational resources and tools, has a great potential to improve healthcare consumers' understanding of health related issues, patient-clinician collaboration and patient self-management , and thus contribute to better health outcomes (Wagner et al., 2010). Other potential benefits of patient portal include patients' ability to verify accuracy of information contained in provider managed EHR, avoidance of duplicate tests and other convenience related functions such as ability to request appointments and prescription refills online, as well as the ability to manage insurance benefits and claims (National Committee on Vital and Health Statistics, 2006).

The purpose of this research is to review literature related to user perception, satisfaction and utilization of existing portals and to identify critical features and functions that are vital to a success and wide spread utilization of patient Web based

portals. This paper consists of two main parts; the first section examines a variety of definitions that are currently used to describe patient portals and evaluation of portal functionalities that could assist providers and healthcare organizations in meeting the meaningful use requirements. The second section of this paper focuses on the key factors and barriers influencing wide spread adoption of patient portals.

II. DEFINITIONS

There is a wide range of terminology used to describe various types and functions of personal health record and patient portals. The variations of *personal health record* and *patient portal* terms are used interchangeably throughout the literature. Many entities define "personal health record" in their own unique way. It is important to characterize some common definitions that are currently in use in order to better understand the differences, as well as the significant evolution of the personal health record, its transition into the patient portal system and the associated capabilities we observe today.

Personal Health Record (PHR) simply defined, is a medical health related record that is owned and maintained by an individual (Liu et al., 2011). However, various entities define PHR differently, the Health Information Management Systems Society (HIMSS) defines PHR as *"an electronic repository where a patient can store his/her health data privately and securely and share this data with healthcare providers and others at the patient's discretion"* (HIMSS, 2008) HIMSS also offers separate definition for electronic Personal Health Record (ePHR) which is defined as "*universally accessible, layperson comprehensible, lifelong tool for managing relevant health*

information, promoting health maintenance and assisting with chronic disease management via an interactive, common data set of electronic health information and e-health tools" (HIMSS, 2007). The office of the National Coordinator for Health Information Technology (ONCHIT) simply defines PHR as *"an electronic application through which individuals can maintain and manage their health information in a private, secure, and confidential environment."*[4] The National Alliance for Health Information Technology (NAHIT) defines PHR as *"an electronic record of health-related information on an individual that conforms to nationally recognized interoperability standards and that can be drawn from multiple sources while being managed, shared and controlled by the individual"* (NAHIT, 2008).

Personally Controlled Health Record (PCHR) is a term originally established to differentiate from the early PHR systems offered by some health care organizations, in which patients were offered a static view of limited personal health information directly from the organization's EHR system. Legacy PHR systems that were under full control of the host institution had no other functionality besides the patient's ability to view certain health information (Trotter & Uhlman, 2011). Others have defined PCHR as a system that enables the consumer to add data sources from diverse sites such as clinic, hospitals, pharmacies and labs, by *"integrating streams of institutionally tethered health information into master, patient controlled (life-long) record"* (Bourgeois et al., 2009; Weitzman et al., 2009). This definition provides a unique component of adding electronic data from multiple sources which is absent in other PHR related definitions. Examples of PCHR include Google Health, Microsoft's HealthVault, and Indivo PCHR

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[4] Source: http://healthit.hhs.gov

in which patients can import or manually enter their health related information (Weitzman et al., 2009). PCHRs do not include institution specific features such as appointment management, messaging, and prescription refills (Bourgeois et al., 2009).

Health Record Bank (HRB), also called Health Record Trust, is a relatively new term. The Health Record Banking Alliance defines Health Record Bank as any organization that provides an electronic repository for storing and maintaining an individual's comprehensive health and medical records from multiple sources including the individual[5]. The Health Record Bank, derived from the introduction of the Independent Health Record Trust Act of 2007 the goal of which was to *"improve the availability of health information and the provision of health care by encouraging the creation, use and maintenance of lifetime electronic health records of individuals in independent health record trust."* [6] HRB should not be confused with the model adopted by several Regional Health Information Organizations (RHIOs) where multiple medical organizations are linked into a network for the purpose of sharing patient's electronic health records (EHR) data, these EHR records are under ownership and control of the health care provider (Dimick, 2008). In the case of HRBs, individuals are the owners of the account, just like accounts held in a financial institution, and as such are able to grant access to their health information when needed (Detmer et al., 2008). One of the major advantages of the HRB is patients' ability to request transfer of their EHR information from multiple providers. This advantage however, comes with the assumption that the providers have EHR data transfer capability and sign a data transfer agreement with the HRB host. A major disadvantage of the HRB is that it serves as a single repository of

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[5] Source: http://www.healthbanking.org
[6] Source: http://www.govtrack.us/congress/bills/110/hr2991

patients' electronic health data and often provides no other tools or features that could help account holders improve communication with their healthcare provider or enable them to better manage their health.

Patient Web Portals (PWPs) - California HealthCare Foundation defines patient portals as a secure Web site through which patients can access their PHR, which is integrated with an organizations' EHR. Some refer to patient portals as PHRs that are connected to a specific organization's information system (Tulu et al., 2012) others define Internet portals as a type of PHR in which patients are able to view "shared chart information" (Wald, 2010). Portals enhanced functionality typically enable users to complete registration forms online, schedule medical appointments, request prescription refills, review lab results and often offer ability to communicate with their healthcare providers through secure messaging (California HealthCare Foundation (CHCF), 2010). Additional benefits of some PWPs include ability to view/pay medical bills, complete online pre-appointment screening forms, receive appointment reminders and personalized or condition targeted educational resources (Osborn et al., 2010). Patient Web portals are managed by the sponsoring institution (Bourgeois et al., 2009) which often grants access to users after some type of identification verification procedure.

As seen from various definitions the meaning of terms varies and there is no clear distinction between PHR, ePHR, and PCHR, and PWP, these terms are often used interchangeably. While some definitions incorporate data integration from multiple sources, others focus on PHR as a tool for managing individuals' health related information. A common theme between the various terms is that they are electronic and

secure. With the exception of patient portal, all others are owned and managed by an individual. Integration of information from patients' EHR record, and a variety of interactive functions is what truly distinguishes Patient Web Portals from the standard PHRs. In addition, while PHR can be offered by any entity, patient portals are often offered to consumers by a specific health organization, an insurer, or an employer and thus by nature of their affiliation can provide more comprehensive services to its customers.

III. BACKGROUND

The PHRs have been utilized for many decades allowing individuals to collect and store health related information in a single place. Initially, the personal health record was a paper based collection of health related documents which were gathered from various sources, stored in a file cabinet or a binder at home and maintained by an individual (Detmer et al., 2008). With the introduction of personal computers, and later PHR software, traditional paper based health record keeping transitioned into electronic format allowing individuals to better organize their health related information in an electronic format. Subsequently, the wide spread use of the Internet and its capabilities introduced web-based PHRs, patients were able to enter and store their health information and access the information from anywhere the Internet connection was available. PHR systems vary significantly in features and capabilities offered to the end user. There are three distinct PHR classification models: standalone, tethered and integrated.

Standalone PHR serves as a static repository of patient entered health information. Standalone systems include paper based PHRs, PHR software used on individuals' personal computer, and Web based PHRs that are managed by the individual (Tang et al., 2006). Web based PHRs are similar in function to those maintained by the individual on their personal computer; however, they also offer password protection, 24/7 access anywhere Internet access is available and data loss prevention. PHR data is stored on a web server which is periodically backed up. Users are protected from loss of their health related data due to theft, deletion or hard drive failure, which could occur if an individual maintains their PHR on a local computer (Detmer et al., 2008). This type of model is often utilized by standalone *Health and Wellness Portals*, in which patients are able to enter their demographic and health information, including medication lists and allergies, and other relevant information. Using specifically designed imbedded algorithms patients are able to receive personalized sets of evidence-based preventive service recommendations (Chou et al., 2010). These portals also offer a variety of tracking tools and calculators, which enable users to set and track their health related goals, monitor and manage specific health related conditions, and access verified (and often personalized) health related education materials (Detmer et al., 2008). The major disadvantage of a standalone PHR is the need for an individual to manually enter their health data and regularly update it, which could be a time consuming and daunting task requiring significant effort on the part of a user, especially for individuals with multiple health issues. Additionally, since standalone PHRs are not interconnected with the providers' systems they do not offer any communication or convenience features.

Tethered PHR systems are sponsored and maintained by a provider, a healthcare organization (Wagner et al., 2010), or insurer (Liu et al., 2011). The main advantage of tethered PHR is that the requirement for patient entered data is greatly reduced as key health information is imported directly from patients' electronic health record (EHR) or a health plan claims data maintained by the insurer (Liu et al., 2011; Wagner et al., 2010). In addition to viewing information maintained by patient's healthcare provider or insurer, patients may also be able to enter their own information, such as health journals, for their personal use. It is important to note that patient entered information is not electronically transferred back to the site sponsor; however, the individual is able to print needed information and share it with their provider during the next visit. Some tethered PHRs also utilize a variety of tools and health specific information provided on the host site. Since tethered PHR systems are institution specific, patients are able access their PHR via organization's web-based portal (Detmer et al., 2008), and thus are frequently referred to as *Patient Portals* or EHR-based systems (Tang et al., 2006).

Integrated PHR systems are more sophisticated. What differentiates them from tethered systems is the capability to provide data from multiple sources including multiple EHRs, insurance claims, pharmacy data, and even recorded data from home diagnostic devices (Detmer et al., 2008). Most integrated PHRs offer individuals a variety of convenience tools such as appointments booking, prescription renewals, prevention and wellness reminders, and patient-provider communication tools such as secure messaging (Detmer et al., 2008). Data in these types of PHR systems is controlled by the portal provider, and patients can access the site when given access by the portal

sponsoring institution (Bourgeois et al., 2009). Integrated PHRs systems are often

referred to as *Patient Portals*.

Summary of Definitions			Sharing ability	Availability	Completeness	Information sources	EHR Information
Type	Term used	Format					
Standalone	PHR	Paper Based	No	Limited	Low	Patient collected	No
	PHR, ePHR	Electronic/Software/ PC based	Limited	Limited	Low	Patient entered	No
	PHR, ePHR	Web-Based *e.g. Wellness Portal*	Depends on Provider	24/7	Low	Patient entered	No
Tethered	PHR, ePHR, PWP	Web Based	Depends on Provider	24/7	Medium	Limited	Yes *(Single Source)*
Integrated	PHR, ePHR, PCHR, PWP	Web Based Interactive	Depends on Provider	24/7	Medium/High*	Multiple	Yes
	HRB	Web Repository	Yes	24/7	Potentially High	Multiple	Yes

Table 1. Summary of Definitions

As seen from the summary of definitions above, there is no uniform definition to

clearly distinguish terms and their associated functions. Many individuals talk about (and

evaluate) PHRs without realizing that their respective notions may be quite different

(National Committee on Vital and Health Statistics (NCVHS), 2006). For the purpose of

this paper, the term *patient portal* will be defined as a web based application sponsored

by the healthcare organization, in which patient is required to obtain some type of

authorization from the portal sponsor and establish a password in order to gain access.

The minimum functional requirements of a patient portal include integration with host's

EHR system and interactive features, such as appointment booking, prescription refill

requests and secure messaging, important elements which can aid healthcare

organizations achieve meaningful use objectives described in detail below.

IV. Patient Portal Role in the MEANINGFUL USE (MU)

Increased adoption and meaningful use of EHR technology among providers and

hospitals is a key to successful healthcare modernization strategy and the achievement of

health and efficiency goals set forth by the HITECH Act. In an effort to encourage and

accelerate adoption and meaningful use of the EHRs the Centers for Medicare and

Medicaid Services (CMS) introduced financial incentive programs (Centers for Medicare

and Medicaid Services Website, 2012). Under such programs eligible hospitals and

healthcare professionals who adopt, implement, or upgrade their information systems

with an EHR certified by the Office of the National Coordinator for Health Information

Technology (ONCHIT) and demonstrate meaningful use of this technology will be

eligible for incentive payments. The CMS offers incentive payments to eligible hospitals

and healthcare professionals under two different programs, Medicare EHR Incentive

Program and Medicaid EHR Incentive Program. The two programs differ in the

eligibility criteria as well as the maximum payout amounts and although qualifying

hospitals could be eligible for both programs, the healthcare professionals who qualify

for both programs must only choose and register for one. It is important to note that

although the CMS programs are currently an incentive in nature, in 2015 professionals

and hospitals who are eligible for the Medicare program but do not meet the meaningful

use requirements will have their reimbursements reduced by 1% and additional reduction

of 1% each year thereafter for the maximum of 5%.

Eligibility Requirements

Under Medicare incentive program eligible professionals are defined as doctors of medicine or osteopathy, dentist, optometrists, podiatrists and chiropractors. The maximum incentive for those who meet the qualifications is $44,000 which is paid out over the period of five years, assuming the participants meet the reporting requirements and register for the program by 2011. In addition, eligible professionals who provide services in the areas designated by the U.S. Department of Health and Human Services as Health Professional Shortage Area (HSPA), are eligible for additional 10% increase to their maximum incentive payment amount. Under Medicaid program eligible professionals are defined as physicians, nurse practitioners, certified nurse-midwives and dentist with a minimum of 30% of Medicaid patient volume (20% for pediatricians) or those practicing predominantly in a Federally Qualified Health Center (FQHC) or Rural Health Centers and have minimum of 30% of disadvantaged population. Under the Medicaid incentive program eligible professionals can receive up to $63,750 over the six years if they start their participation in the program in 2011.

Medicare incentive program for eligible hospitals offers payments based on a number of factors, starting with a base payment of $2M. Eligible hospitals include those that accept patients with Medicare Part A, Medicare Advantage (MA) or MA-affiliated hospitals, and Critical Access Hospitals. Acute care hospitals with at least 10% Medicaid patient volume and children's hospitals are also eligible to register for the Medicaid EHR incentive program which offers the $2M base payment. Hospitals eligible for both programs can register and take advantage of financial incentives offered by both programs.

Although the payments received through the Medicare and Medicaid EHR incentive programs are just what the name says, an incentive, and they are not enough to cover all the costs associated with the implementation of EHR, the interest in the programs is impressive. As of December of 2011, over $2.4 billion in Medicare and Medicaid EHR incentive payments have been made to over 59 thousand eligible providers and over two thousand hospitals (Tavenner & Mostashari, 2012).

MU Objectives

Medicare and Medicaid EHR Incentive Programs consist of 3 different stages of meaningful use requirements, with each stage requiring a progressively increasing use of EHRs and electronic information exchange (CMS Office of Public Affairs, 2012). In July 2010 CMS published a final rule on Stage 1[7] of meaningful use criteria, in which the eligible professionals must meet all 15 core objectives, eligible hospitals must meet 14. Additionally, both must select and meet 5 out of 10 menu objectives. Although the Stage 1 requirements do not specifically necessitate implementation of patient portal, two of the core requirements and three menu items, could be easily met by implementing a web based patient portal.

(1) Provide patients with an electronic copy of their health information which includes test results, problem list, medication list and allergies

(2) Provide clinical summaries to the patient after each office visit

(3) For hospitals, provide patients with a copy of their procedures and discharge instructions

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[7] Federal Register, MU Stage 1 - Final Rules. 28 Jul 2010: http://www.gpo.gov/fdsys/pkg/FR-2010-07-28/pdf/2010-17207.pdf

Menu items that could be met via utilization of patient portal features include ability to send patient preventive and follow-up care reminders, provide patients with timely electronic access to their health information, and provide patient-specific educational resources to the patient.

In February 2012, at the Healthcare Information and Management Systems Society's (HIMSS) annual conference in Las Vegas which I attended, Farzad Mostashari[8] officially announced that the proposed requirements for Stage 2 Meaningful Use criteria have been submitted for last comments. Final rule on the criteria is expected to be released this Summer. The Stage 2 Meaningful Use objectives are an extension of Stage 1, and are expected to become effective in 2014[7]. Unlike the earlier stage, Stage 2 criteria recommendations include more specific implication for a need and utilization of web based patient portals and its features. One of the newly introduced requirements includes providing patients, or their designated representatives, with the ability to view, download, and transmit their health information online.   This requirement incorporates several requirements from Stage 1, providing patients with timely electronic access to their health information, providing patients with an electronic copy of their health information including visit summaries and discharge instructions[9]. Another new objective introduced in Stage 2 is the use of secure electronic messaging to communicate with patients. In addition, sending patients preventive and follow up reminders is now a core requirement. *Table 2* below provides a summary of portal related meaningful use objectives.

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[8] Farzad Mostashari serves as the National Coordinator for Health Information Technology (HIT) , Office of the National Coordinator for Health Information Technology, U.S. Department of Health and Human Services

[9] Source: Federal Register, MU Stage 2 - Proposed Rules. 7 March 2012. http://www.gpo.gov/fdsys/pkg/FR-2012-03-07/pdf/2012-4430.pdf

Meaningful Use Objectives				
	Provide patients with an Electronic Copy of their:	Requirement	Provider or Clinic	Hospital
Stage 1 *(Final Rule)*	- (1) Lab Results	Core	X	
	- (2) Problem List	Core	X	
	- (3) Medication List	Core	X	
	- (4) Medication Allergies	Core	X	
	(5) Clinical Summary	Core	X	
	(6) Procedures & Discharge Summary	Core		X
	Patient-Specific Educational Resources	Menu	X	
	Sent preventive/follow up reminders	Menu	X	
	Provide Patients with timely electronic <u>access</u> to their health information (including items 1-4 identified above)	Menu	X	
Stage 2 *(Proposed)*	Provide patients with ability to view online, download & transmit their health information (incl. item 1-5)	Core	X	X
	Use secure electronic messaging to communicate with patients	Core	X	
	Sent preventive/follow up reminders	**Core**	X	

Table 2. Summary of Meaningful Use Requirements Relating to Patient Portal Capabilities.

Providers and healthcare organizations who establish patient portals as a communication gateway to reach their patients, could also easily fulfill partial requirements of the meaningful use objectives. Organizations or providers not eligible to participate in the incentive program could take advantage of the many benefits offered by the available portal features. Providing patients with convenient access to the services offered, improving documentation of communication with patients, enabling patients to verify accuracy of information contained in the EHR, streamlining new patient registration process, improving the quality of patient care by providing personalized features and customized educational content, and consequently enhancing relationship with their patients and improving overall patient satisfaction (Emont, 2011; Lin et al., 2005; National Committee on Vital and Health Statistics (NCVHS), 2006; Tang et al.,

2006; Tulu et al., 2012). The use of available portal technologies to meet the meaningful

use requirements, not only provides patients with easy access to pertinent information

and convenience tools, but as noted by the PwC Health Research Institute (Appendix,

Figure 1), it has a potential to entirely revolutionize the healthcare experience for patients

(PwC Health Research Institute, 2011).

V. Consumer Interest & Adoption

      Disparities between consumer demand and use of PHRs have been noted

throughout the literature (Kaelber et al., 2008; Liu et al., 2011; Nazi, 2010; Wald, 2010).

A closer look at a variety of healthcare consumer surveys reveals high consumer interest

and unmet demand for online access to electronic health records and its associated

convenience, and communication tools offered by patient portals. The surveys measuring

the adoption and use of PHRs often do not differentiate stand alone systems from the

fully functional patient portals. Portals provided by healthcare organizations in which

patients can utilize a wide range of convenience and communication tools not available in

a standard view only or standalone PHRs. 2008 Deloitte survey reported, that while 6%

of those surveyed accessed their medical records and test results online, only 3% reported

accessing an integrated medical record (Deloitte Center for Health Solutions, 2008),

which was most likely accessed via a healthcare on insurer sponsored patient portal.

The same survey revealed that nearly 80% of consumers are interested in gaining access

to their medical record through a provider sponsored patient portal that combines

information about test results, doctor visits and hospital stays. Three out of four

consumers would like physicians to offer online services enabling them to schedule appointments and exchange e-mails (Deloitte Center for Health Solutions, 2008). Another survey noted an increase in the adoption rate, 10% of consumers reported using "computerized PHR", which included stand alone PHRs as well as patient portals established by insurer, employer or a healthcare institution (Deloitte Consulting, 2010).

Similar survey results were reported by the California HealthCare Foundation (CHCF), where 7% of those surveyed have used PHR technology. However, a majority of those users (51%) reported their PHRs being provided by the health insurance plan while only 26% were offered by their healthcare provider. The other 36% of PHR users reported their PHR being offered by an employer or other entity, such as WebMD, or did not specify the source (CHCF, 2010). The PwC[10] Health Research Institute's Consumer Survey reports even lower rate (14%) of those who access their medical records through their doctor's office or a hospital (PwC Health Research Institute, 2011). The surveys reveal that consumers have a significant interest in electronic access to records along with the desire to use portal associated conveniences and communication tools, yet due to the fact that the majority (54%) of available PHRs are stand alone products (Jones et al., 2010) or are provided by other than healthcare institution hosted patient portals and lack those desired features, adoption of standalone PHRs among consumers is low. Perhaps the most notable implication of unmet consumer needs is the fact that 66% of surveyed consumers would consider switching to a physician who offers access to medical records through a secure portal (Deloitte Consulting, 2011).

Studies examining adoption of a specific patient portal offered by a healthcare organization found much higher adoption and utilization rates. In 2005, a study of

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[10] "PwC" refers to PriceWaterhouseCoopers, LLP

MyGroupHealth, a Group Health Cooperative's Patient Web Portal, reported 25% of eligible patients completed ID-verification process and registered for portal services (Ralston, Hereford, & Carrell, 2006). Howard University Hospital's Diabetes Treatment Center implemented *NoMoreClipboard*, an integrated web portal designed to serve underprivileged diabetic patients, and found not only 26% portal adoption rate among urban poor, but it has shown the highest utilization rate (87%) among Medicaid patients (Moore, 2010). Another study of a patients' in pronominally low income areas reported 60% adoption rate for *MyChart* patient portal, of those who registered, 81% used portal more than twice (Ancker et al., 2011). Northwestern Medical Faculty Foundation's patient web portal reported 69% enrollment rate and 76% utilization rate among its eligible population (Goel, Brown, Williams, Hasnain-Wynia, et al., 2011) and the Kaiser Permanente's *My Health Manager* has 41% of its eligible users registered and utilizing portal features (Sue et al., 2011). These studies illustrate significantly higher adoption and utilization rates among users of patient portals sponsored by a healthcare or insurer organizations. Interestingly, despite similar features offered by all of the portals the differences in enrollment rates are significant, from 26% to 69% of eligible population, the next section will evaluate various factors influencing consumers' adoption of patient portals.

VI. Factors Influencing Portal Adoption (*Among Healthcare Consumers*)

Consumers' Motivation

Understanding patients' needs and preferences when it comes to the design and features offered by a patient portal is a key to its successful adoption and utilization. As

with any technological innovation, portal adoption (or failure) depends heavily on the end

users' perception of its usefulness and perceived ease of use of a portal system. This is

consistent with an evaluation of many information technology acceptance studies using

the well known Technology Acceptance Model (TAM) (Davis, 1989). The external

variables, such as consumers' access to the computer and the Internet, computer and

health literacy levels, and socio-economic aspects are the initial factors impacting a

patient portal adoption and have been studied extensively (Ancker et al., 2011; Jung et

al., 2011; Roblin et al., 2009; Sarkar et al., 2010; Sue et al., 2011; Weingart et al., 2006;

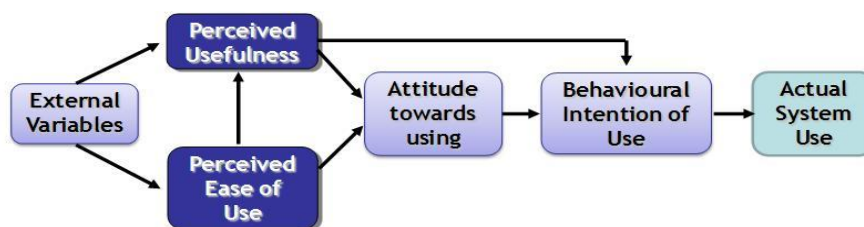Weitzman et al., 2009; Yamin et al., 2011)

Figure 1. Technology Acceptance Model (TAM) (Davis, 1989)

Aside from the external variables, consumers' motivation to adopt patient portal

technologies depends heavily on the type and the usefulness of the offered features. For

example, increased motivation to utilize patient portals has been noted among consumers

who experienced difficulties in obtaining needed information and were dissatisfied with

existing provider communications methods, including staff non-responsiveness to

patients' information needs (Zickmund et al., 2008). Another study noted a steady

increase in portal users' access to the after-visit summaries, which provided patients with

a personalized plan of care and links to relevant educational materials, suggesting that

consumers' motivation to utilize portal features is a result of *"unmet information and care needs"* (Ralston et al., 2006).

Many portal evaluation studies (Appendix, Table 1) report that convenience and communication tools, such as prescription refills, appointment management, laboratory results and secure messaging, are the most utilized features among portal registered users. Furthermore, satisfaction rates with those communication and convenience features among portal users are also high, signifying consumers' motivation to utilize portals might be greatly diminished if such features are limited or not offered. The convenience and patients' continuous access to medical information were also found to be a primary motivator for continued use of the system (Tang & Lansky, 2005; Tulu et al., 2012).

In addition to consumers' perceived usefulness of a portal, their perception of importance and a potential impact on one's health (Chou et al., 2010) also influences consumers' motivation to adopt portal technology. Among portal non-users, many did not view the portal as helpful, believed it lacked features they desired, or were not aware of all the functionalities offered by the portal (Goel, et al., 2011; Osborn et al., 2010; Tulu et al., 2012), suggesting lack of consumer awareness, relating to a portal and its features might also play a role in consumers motivation and ultimately the adoption and use of a portal. Other portal non-adopters reported their information needs were met through existing e-mail, phone, and face-to-face communications and believed portal offers no additional benefits; in fact, portal non-users feared the use of portal technology might negatively impact their existing relationship with a provider (Zickmund et al., 2008).

Portal Usability

    As with any information system, portal usability also needs attention in order to

ensure that those who desire to utilize portal features do not encounter unnecessary

obstacles. The evaluation of portal usability begins with an assessment of user

registration process. In an attempt to make the information on the portal secure, and to

ensure that it is accessed only by authorized users, organizations have put into practice a

requirement for in person authentication or implemented other procedures to ensure

account security. These countermeasures, although effective in protecting individual's

personal health information, could have an impact on a portal adoption. Account creation

and registration process is the first step potential portal users encounter. Lengthy, and at

times difficult registration process has been noted in portal utilization related studies

(Haggstrom et al., 2011; Nazi et al., 2010; Sarkar et al., 2010). One study also noted that

during the registration process some users had difficulty creating valid passwords and a

color blind participant could not read the registration error message in red (Haggstrom et

al., 2011). A requirement for in person authentication before an access code or a

temporary password is issued followed by additional registration requirements has a

potential to discourage potential portal users. For example, the Veterans Affairs' (VA)

My HealtheVet portal utilizes two tiered access to its portal, one for on line registrants

who can access standalone PHR features in which users are only able to self enter their

health related information and have no access to other features, and the second one which

is restricted to authenticated users only and offers portal features such as prescription

refills, wellness reminders and secure messaging. While over 810K veterans registered

for standard access, only 150K have completed the authentication process (Nazi, 2010).

A usability study of the same portal reported that only 25% of study participants successfully completed the registration process (Haggstrom et al., 2011). Some organizations require that in order to gain access patients first must register online, and then wait to receive a letter in the mail with a default password (Sarkar et al., 2010; Yamin et al., 2011). This lack of immediate access creates possible discouragement among those initially motivated to use the portal. It is critical that organizations implementing a portal carefully consider their patient access policies and procedures. One possible solution to a cumbersome registration processes could be setting up registration help/verification station on site, so the patients can walk out of the clinic with ID verification process completed and user account created. This of course, could involve the need for additional personnel resources; however, self-serve onsite enrollment kiosks (Yamin et al., 2011) could be implemented and help reduce or even eliminate the need for staff presence. Another possibility could include a close evaluation of the registration process and a look at other industries' authentications procedures, such as financial institutions, which often use other than in person authentication method to grant access to individual accounts. In 2010, *Patient Gateway* portal authentication procedures have been changed to online authentication enabling patients to receive their initial password immediately after online registration (Wald, 2010).

Other usability features mentioned briefly in the literature is the portal design, including color theme, font size, information layout and navigation, which all have an impact on user's ability to quickly find needed information (Britto et al., 2009; Chou, et al., 2010; Sarkar et al., 2010). As in any information system the end user presentation

layer of an application impacts its usability; however, patient portals face a unique

challenge related to the type of information they convey to users. Complex medical

terminology, lab values, and prescription medication terms, or use of ICD-9 diagnoses

codes contained within the provider managed EHR could present a challenge when it

comes to consumers' comprehension of such information. A study which evaluated and

analyzed usability of *MyCare Connection*, a pediatric patient portal, found that portal

users (parents of chronically ill children) had trouble understanding medical terminology

and laboratory test abbreviations, and needed clarification for numerical values of height

and weight, which were presented in metric system instead of generally accepted in US

metrics (Britto et al., 2009). *My HealthLink* portal users also had difficulties

understanding medical terminology, in this case the issue was alleviated by

implementation of medical terminology glossary (Wagner et al., 2010). Thus, one of the

critical components of useful patient portal system is the ability to translate complex

medical terminology, metric system components, and ICD-9 codes from a clinician

centered EHR system into a consumer focused patient portal in terms that are understood

by general public. In addition, a utilization of user preferred data display methods, such

as lists, bar charts, calendars, will impact how users understand presented information

(Marchionini et al., 2007). Others also noted that *"optimal benefits (of patient portal) can

be realized when the need for patient centered terminology and data presentation are

adapted"* (Tang et al., 2006). The method in which medical information is organized

and presented to a user greatly influences their comprehension of presented information

(Britto et al., 2009; Marchionini et al., 2007). Portal interface design, the layout of the

content presented, as well as the data presentation techniques have a direct impact on users' engagement and thus the ultimate adoption and utilization of portals.

Marketing Strategies

Strategies employed by an organization to advertise and encourage patient enrollment could have a significant impact on the level of consumers' adoption and utilization of patient portals. In some instances, the responsibility for advertisement and patient enrollment has been delegated to clinical staff. In many organizations patients are informed and invited to enroll in a portal at the discretion of the provider during a patient visit (Ancker et al., 2011; Goel, Brown, Williams, Hasnain-Wynia, et al., 2011; Moore, 2010; Tulu et al., 2012; Wald, 2010; Zickmund et al., 2008). Although provider initiated portal promotion and enrollment strategies may carry an influential clinician's endorsement, such strategy alone presents a major concern with regards to the quality and uniformity of a message among various providers. A portal enrollment studies have shown that providers' perception of portal usefulness can vary and had a major impact (from 0% to 98%) on patient panels enrollment rates (Roblin et al., 2009; Wald, 2010; Weingart et al., 2006). Furthermore, providers' willingness to promote portal during the patient's visit could be impacted by appointment time constrains, especially for the patients with multiple health concerns which must be addressed during the visit (Tulu et al., 2012). A clinicians' preconceived notion of who might, or might not be a good candidate for portal use, may influence their decision to promote its use as well. Consequently reliance on clinicians who already have limited time with a patient to promote portal use could be ineffective. However, their awareness of portal features and

capabilities could positively influence portal adoption when coupled with other institution-wide marketing initiatives (Wald, 2010).

Aggressive portal promotion strategies aimed at raising awareness of available portal features using a variety of promotional activities, have shown much higher patient enrollment and portal utilization rates (Sarkar et al., 2010; Sue et al., 2011; Yamin et al., 2011). Kaiser Permanente publicizes *My Health Manager* portal through television, radio, print, and the Internet advertising (Sarkar et al., 2010). Others use automated greetings into practice's telephone system, posters in waiting areas and exam rooms, postcard and letter mailings, and offer onsite enrollment (Yamin et al., 2011). These comprehensive promotion strategies have a potential to reach all of the possible portal stakeholders', including current and prospective patient populations, clinicians, administrative personnel and organizational leadership , and create unified awareness of the portal and its capabilities among all. In addition, organizations should ensure that clinic personnel is appropriately trained and able to provide assistance to consumers' portal related inquiries (Sarkar et al., 2010; Yamin et al., 2011).

VII. Barriers to Portal Adoption (Healthcare Institutions)

EHR Utilization

Since the principal foundation of a truly functional patient portal is its interconnectivity with organizational EHR system, the most obvious barrier to a wide spread adoption of patient portals is a diffusion of EHRs systems among healthcare organizations and individual practices. Although significant increase in adoption of EHR among private practices and hospitals has been noted, organizations without EHRs still

account for more than half. As mentioned earlier, the overall EHRs adoption rate is

45.6%; however, the use of EHR systems is distributed unevenly among various size

organizations, from 77% of large organizations[11] to a much lower 42% of small

practices[12] reporting EHR use[13] (SK&A Report, 2012). Among practices which have not

yet adopted EHR systems, many may lack financial resources to cover the costs

associated with the implementation of EHRs, especially if they do not qualify for any of

the financial incentives payments offered by the CMS.   Organizations must not only

consider the price of the EHR platform, but associated installation, hardware, human

resource, and system maintenance related expenses as well. Those considering

purchasing an EHR solution should consider vendors offering patient portal features as

part of the EHR package[14], a strategy which could minimize the overall implementation

and maintenance expenses for both systems.

For organizations which have already acquired EHRs solution, the prospect of

spending additional funds to implement patient portal technology might be unendurable

financially and difficult to justify. Although portals promise increased patient

involvement and satisfaction, and have ability to improve patient-provider

communications, none of those measures are easily quantifiable (Detmer et al., 2008;

Emont, 2011) to allow for a solid computation of return on investment. Nevertheless, the

steady increase in use of EHR technology among all types and sizes of healthcare

organizations has a potential to significantly impact the future adoption of patient portals.

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[11] Organizations with 26 or more providers

[12] Practices with 1-2 providers; an average of 1-physician (36.9%), 2-physician(47.1%); FYI 3-5physicians(54.9%)

[13] Despite much lower adoption rate, small practices are currently outpacing larger practices in EHR implementation by 4.1%.

[14] e.g. *MyChart*, offered by Epic Systems

Resistance to Change

      Studies of employee resistance towards a new technology have determined that such resistance is often associated with individual fears and changes occurring as a result of a new system implementation. Often, modifications to workflow processes and establishment of new policies are required; those changes have an impact on existing human interactions and effect individuals' control levels (Jiang et al., 2000; Recardo, 1995). Similarly, relatively new patient-centered portal technology is susceptible to the same resistance among clinicians.

      Implementation of patient portal technology comes with a significant adjustment to a patient-provider relationship. Traditionally, physicians where the "sole holders" of clinical and patient health related information, had a control over dissemination of information, and their contact with patients was limited primarily to scheduled appointments. With a shift towards increased patient involvement and consequent implementation of patient portal, messaging and other capabilities, the patient-provider relationship dynamics have been transformed. The individual provider control over what and when information is released to the patient has been diminished, as organizational policies have replaced providers' individual preferences. In one portal development case, providers wanted to delay release of patients' lab results into a portal by as much as 45 days, while patients' expectation was an immediate release (PwC Health Research Institute, 2011). This gap between providers' and patients' expectations, is a discrepancy that has not been an issue prior to the implementation of a portal technology. Patients were either called or given test results during the next scheduled appointment, and in some cases, often when results were normal, patients were not informed at all. In

addition to varying expectations, continuous patient access to their health information may also have impact on individuals' health behavior and the way they interact with providers (Tang & Lansky, 2005; Tulu et al., 2012).

Studies have noted that physicians have been reluctant to adopt portal technology and use secure messaging feature due to concerns such as liability and privacy, lack of reimbursement, fear of increased workload due to excessive and lengthy patient messages, and inappropriate patient usage (e.g. urgent care) (Chou et al., 2010; Emont, 2011; Liederman et al., 2005; Tulu et al., 2012; Wald, 2010). However, patient abuse of electronic messaging is uncommon, studies showed that most messages were concise, administrative in nature, and often did not require physician's response (Chou et al., 2010; Liederman et al., 2005; Wald, 2010). In fact, some noted that electronic messaging is more efficient than telephone-based requests (Wald, 2010) and it could in fact, be cost effective. Organizations have successfully developed reimbursement schemes in which messages are tracked and later embedded in patients' EHR; and by doing so become a part of official patient record (Chou et al., 2010; Detmer et al., 2008; Wynia & Dunn, 2010). Decrease in phone call volume, office visits and increased provider productivity were also observed (Emont, 2011; Liederman et al., 2005; Tulu et al., 2012). Routing messages to nurse or administrative personnel first, could ensure that only messages needing providers response are routed to the clinicians (Osborn et al., 2011). Addressing non-urgent and preventive care issues via messaging system could potentially increase access and allow providers to focus their face-to-face encounters on more seriously ill patients and consequently lead to much higher reimbursement rates. Another potential

benefit of patient portals is a visit reminder feature that when utilized could contribute to lower costly appointment no-show rates (Horvath et al., 2011).

Successful adoption of portals among healthcare consumers depends as much on patient motivation and system features, as it depends on clinicians attitudes towards this new technology. As such, providers' concerns and fears associated with the portal technology, as well as portal's impact on clinicians' established routines, must be noted and appropriately addressed in order to reduce the key stakeholders' reluctance and apprehension.

Leadership & Policies

Leaders of an organization play a fundamental role in a successful adoption of patient portals. The attitudes of clinicians and administrative staff toward a portal use often are influenced by the leadership's outlook and portal implementation approach. As in deployment of any new system, physical implementation of the most ideal system does not constitute its acceptance, it is the "people" and communication skills employed that are the core of successful adoption. If leadership does not believe in the usefulness and benefits portals could bring to patients and the organization, their actions (or lack thereof), would reflect similar attitudes among clinicians, and consequently result in minimal patient enrollment. A study of portal adoption among 4 practices noted the leadership's attitude towards a portal technology had a significant impact on patients' enrollment rates (Wald, 2010). The study has shown a drastic variation in enrollment rates between a practice with a strong leadership support, which had an overall patient enrollment rate of 72%, and a practice which lacked such support, whose enrollment rate

after a 5 year study period was only 11% (Wald, 2010). Same study also noted that leaderships' approach towards incentivizing portal adoption could also influence employees' acceptance. Creation of internal practice incentives, such as a healthy competition among staff, has shown increased motivation and interest in monitoring enrollment statistics, which have likely contributed to increased portal adoption among staff and patients (Wald, 2010).

Implementation of a patient portal is a process in which leadership must be actively involved. First, leaders must clearly communicate the reasons behind their portal deployment decision to all of the stakeholders. Meeting meaningful use requirements might not be the best convincing argument, especially for providers employed by hospitals who would not directly benefit. The reasons for deployment of patient portal technology must be aligned with organizational strategy and support organization's goals and objectives. If the proposed change does not support organizational goals it would be difficult for the stakeholders to accept the change as something that is necessary (Ranken, 2007). Second, establishment of a portal implementation strategy is essential to its adoption. In the pre-implementation stage, policies and procedures associated with portal deployment must be developed. Decisions relating to the portal functionalities, type of clinical data released through the portal, timing of the release, and measures employed to ensure portal user' authentication, privacy and security must be made (Bourgeois et al., 2009; Collins et al., 2011).

Due to inconsistencies among state and local polices, leadership must also take into consideration applicable state laws when developing internal policies. For example, the state of California requires additional physician and patient consent for patients'

electronic access, California and Washington laws also state that certain results cannot be released electronically (Collins et al., 2011; Tang & Lansky, 2005). Policies and procedures relating to how, by whom, and in what timeframe and electronic messages will be handled, tracked and answered must also be established (Osborn et al., 2011). Leadership must ensure clinicians and other stakeholders are included in this planning stage and the creation of policies and procedures. This would ensure that all the process and workflow related issues and concerns are identified and addressed early, before the actual implementation of the portal.

Organization wide dissemination of those policies and procedures will aid leadership in conquering some of the concerns and fears mentioned in the previous section. Encouraging staff to create their own portal accounts may also help improve their understanding of the portal features and its value to patients (Wald, 2010). Additionally, clinician might need reassurance that portal features are not meant to replace standard communications with their patients, but rather complement them and should be viewed as an extension of services offered to the patients (Wald, 2010). Leaderships' role and their impact on a successful adoption of patient portals could have been underestimated; many barriers to a successful adoption can conquered, or at least impacted, by the leaders' attitudes and their approach toward patient portal technology.

VIII. Conclusion

Patient portals offer many benefits including convenience and value to the consumers, greater patient engagement, improved communication and information sharing among patients and their providers. Healthcare organizations can benefit, by

improving relationship with patients through continuous communications, increased

patient satisfaction, and a potential for improved provider efficiencies. However, those

and many other advantages cannot be realized without wide spread adoption and

utilization of patient portals, first among health care organizations and subsequently by

the healthcare consumers. Patient acceptance and utilization of portal technologies is

strongly influenced by systems' functionality, usability, providers' attitudes, marketing

strategies employed and organizational leadership support.

It is only when the adoption and utilization rates are at their highest that the true impact of patient portal technology could be measured and the anticipated potential realized.

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Acronyms

AHRQ - Agency for Healthcare Research and Quality

ARRA - American Recovery and Reinvestment Act

CMS - Centers for Medicare and Medicaid Services

HHS - Health and Human Services

HIPAA - Health Insurance Portability and Accountability Act

HITECH - Health Information Technology for Economic and Clinical Health Act

HRSA - Health Resources and Services Administration

ICD-9 - International Classification of Diseases, 9th Revision

MU - Meaningful Use

NCVHS - National Committee on Vital and Health Statistics

ONCHIT - Office of National Coordinator for Health Information Technology

Appendix. Table 1.

Patient Portal Research Literature Summary

Key Features Codes: 1-Lab Results, 2-Appointment Scheduling, 3-Preventive Health Reminders, 4-Prescription Refills, 5- Secure Messaging

No.	Author	Portal	Features	Term Used	Study Type	Key Findings
1	Jung et al. (2011)	MyChart	1-5, eVisits, pre-registration, billing services	Patient Portal	Descriptive Analysis	Evaluation of e-visit feature revealed women are more likely to use the eVisit services, they accounted for 76% of eVisit users. 63% of visits were submitted during office hours, and the median response time was 45 minutes.
2	Ralston et al. (2006)	MyGroupHealth (MyGH)	1, 2, 4, 5, health assessment tools, discussion groups, Healthwise health library, provider directory	Patient Web Site	User Satisfaction Survey	94% overall patient satisfaction with portal features, top features contributing to patient satisfaction were Medication refills (96%), patient provider messaging (93%), Medical test results (86%). Authors noted increasing use of the after-visit summaries.
3	Wald (2010)	Patient Gateway (PG)	1,2, 4,5, Healthwise health library	Patient Portal	Descriptive Analysis	Variation in patient adoption and use of portal among 4 practices is contributed to three main factors: leadership and physicians' attitudes, portal features utilized and marketing methods used.
4	Moore (2010)	NoMoreClipboard (NMC) *linked to clinical diabetes EHR	1, access to problem and medication lists, vitals, demographic info, visit notes; ability to track & trend A1C results	Patient Portal, PHR	Descriptive Analysis	Focused on portal adoption by poor urban Diabetes Treatment Center patients. Overall adoption among diabetes patients is 26%, with the highest adoption among Medicaid patients (87%). 14% decrease in A1C levels and decrease in ER visits attributed to patient portal use.

Appendix, Table 1

Patient Portal Research Literature Summary - Cont.

Key Features Codes: 1-Lab Results, 2-Appointment Scheduling, 3-Preventive Health Reminders, 4-Prescription Refills, 5- Secure Messaging

No.	Author	Portal	Features	Term Used	Study Type	Key Findings
5	Osborn et al. (2011)	MyHealthAtVanderbilt	1,2,5, bill management, insurance information, personalized educational content	Patient Portal	Descriptive Analysis	27% of eligible patients registered for the portal. Among registered users 52% viewed test results and 45% accessed other information from their HER. 45% utilized secure massaging, 39% scheduled appointments, and 29% used bill management feature.
6	Nazi (2010)	MyHealtheVet (MHV)	3, 4, 5, health library, learning center, health screening tools	PHR	Formative Evaluation	Majority of system adopters are male (91%) between ages 51 and 70 (68%) and utilize pharmacy refill feature.
7	Goel et al. (2011)	MyChart*	1, 2, 4, 5, review active medications, allergies and immunizations, request referral*	(Electronic) Patient Portal	Observational, cross sectional study	Focus on patient enrollment and portal utilization. Patients were invited to sign up for patient portal at the discretion of the provider, 69% those who were offered portal access code enrolled. Authors noted disparities in enrollment by race and ethnicity, with 74% whites enrolling, 55% blacks, 64% Latino, 66% Asian; however, once patients enrolled, use of portal was similar across race and ethnicity.
8	Ancker et al. (2011)	MyChart	1-5, review bills & insurance information, update demographic information, MedlinePlus Connect/health information resources**	(Electronic) Patient Portal	Statistical Analysis	60% of invited patients in predominally low income areas activated the account, of these 81% used portal more than twice. Older patients were less likely to receive portal access code from their provider, but those who received the code were more likely to activate the account.

Appendix, Table 1

Patient Portal Research Literature Summary - Cont.

Key Features Codes: 1-Lab Results, 2-Appointment Scheduling, 3-Preventive Health Reminders, 4-Prescription Refills, 5- Secure Messaging

No.	Author	Portal	Features	Term Used	Study Type	Key Findings
9	Weingart et al. (2006)	PatientSite	1,2,4,5, referrals, obtain medication information, update demographic information	Patient Portal	Cohort Study	Most accessed portal features lab results and messaging. Enrollees were younger and more affluent and had fewer medical problems than non-enrollees. Patient panel enrollment among providers varied from 0 - 98%
10	Tulu et al.	Patient Portal	1, 5, prescription renewals, view appointments,	Patient portal, Tethered PHR	Qualitative study	Contradictory to the other studies, younger population of portal users was not the highest utilizes of the portal, in fact the older patients (51-65+) accounted for 70% of portal users and were more likely to utilize portal features on frequent basis. Most utilized features: Appointments, lab results, messaging, medication renewal. Majority of individuals who sign up for a portal continue to utilize the portal regularly.
11	Haggstrom, et al. (2011)	MyHealtheVet	4, health information library, learning center educational courses, health screening tools	Web Based PHR	Quantitative and qualitative observational study	The usability study identified usability issues facing portal users including difficulty with registration, including lengthy password requirements. Prescription refills was the most desired and utilized feature.
12	Goel et al. (2011)	MyChart	1, 2, 4, 5, review active medications, allergies and immunizations, request referral	Patient Portal	Statistical Analysis	Study identified that lack of adequate information and lack of motivation as a primary reasons for non-enrollment in the portal. 30% of patients reported negative attitudes toward the patient portal and did not feel the portal features are useful.

Appendix, Table 1

Patient Portal Research Literature Summary - Cont.

Key Features Codes: 1–Lab Results, 2–Appointment Scheduling, 3–Preventive Health Reminders, 4–Prescription Refills, 5– Secure Messaging

No.	Author	Portal	Features	Term Used	Study Type	Key Findings
13	Lin et al. (2005)	My Doctor's Office	2, 4, 5, request referral	Patient Portal	Randomized Controlled Trial	Portal users demonstrated increased satisfaction with communication with the clinic and higher satisfaction with overall care. Portal's convenience and reduced communication barriers and direct physician responses were the most valued features of the portal. 48% patients were willing to pay for this convenience.
14	Bourgeois et al. (2009)	MyChildren's	1,2,5, demographics, encounter data, billing, self-populated school form, Indivo personal health record	(Tethered) Patient Portal with integrated PCHR	Descriptive Study	Most accessed feature – lab results (82%), study focuses mostly on a design and implementation of patient portal.
15	Sue et al. (2011)	My Health Manager	1, 2, 4, 5, immunizations, account management	PHR	Statistical Analysis	87% of registered users were satisfied or very satisfied with the portal features. Top 3 most utilized features were viewing Lab (64%), secure messaging (46%), and prescription refill (25%). Medicare patients (70+y.o.) were more likely to utilize these features (76%) when compared to 18-29 year old population (52%). Study contradicts well known stereotype of older adults ability to use technology, the authors concluded that age is not longer a barrier to the utilization of many portal features.
16	Britto et al. (2009)	MyCare Connection	1, 5, encounters, user demographics, disease specific information	Patient Portal	Usability Study	Usability testing of pediatric patient portal revealed difficulties in navigation, medical language complexity, error recovery, and provider based organizational schema.

Appendix, Table 1

Patient Portal Research Literature Summary - Cont.

Key Features Codes: 1-Lab Results, 2-Appointment Scheduling, 3-Preventive Health Reminders, 4-Prescription Refills, 5- Secure Messaging

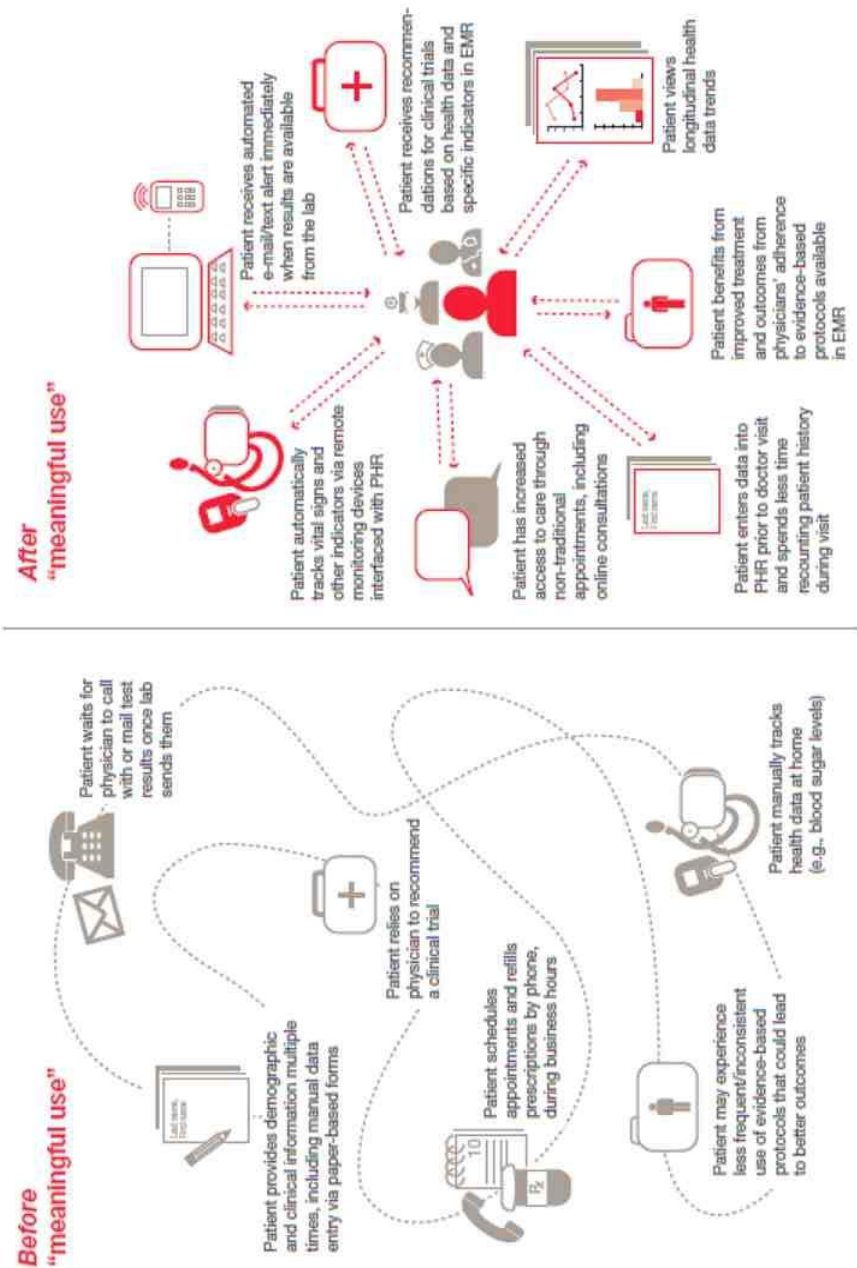| No.	Author	Portal	Features	Term Used	Study Type	Key Findings
17	Roblin et al. (2009)	My Health Manager	1, 2, 4, 5, immunizations, account management	PHR	Cohort Study, Statistical Analysis	35% portal registration rate (2005-2007), 42% white, 31% African American, adults with chronic conditions (37%) were more likely to register than healthier population (30%), most registrants had a postgraduate education (44%) vs. high school or less (24%)
18	Sarkar et al. (2010)	My Health Manager	1, 2, 4, 5, immunizations, account management	(Internet-based) Patient Portal	Statistical Analysis	40% portal enrollment rate. 62% of registered users reported some limitation in health literacy. 43% had health related reading and learning difficulties; 28% reported needing help reading health related materials. Those with limited health literacy were less likely to activate portal account. Most used features: lab results, medication refills, messaging, appointments.
19	Horvath et al. (2011)	HealthView	1, 2, 5, billing, insurance info	Portal	Statistical Analysis	A study measuring an impact of appointment reminder feature on no show rates revealed over all 6.1% lower rate of missed appointments among portal users when compared to non-users. The highest no show reductions were noted among Medicaid (8.7%) & uninsured (12.8%), a populations with traditionally lower portal enrollment rate.

Appendix, Table 1

Patient Portal Research Literature Summary - Cont.

Key Features Codes: 1-Lab Results, 2-Appointment Scheduling, 3-Preventive Health Reminders, 4-Prescription Refills, 5- Secure Messaging

No.	Author	Portal	Features	Term Used	Study Type	Key Findings
20	Zickmund et al. (2007)	HealthTrak	1, 5, health tracking tools	(Computerized) Patient Portal	Qualitative Study	Diabetic population's interest in portal use was linked to their dissatisfaction with current relationship w/ their provider (difficulty communicating, obtaining needed information, office staff non-responsiveness). Patients' disinterested in using the portal had their information needs met through an effective communication with their provider & feared their current relationship will be impacted if they start utilizing portal. Other reasons included difficulty learning the system and patient perceived diminished need for portal since e-mail use outside of the portal has been already in practice.
21	Yamin et al. (2011)	Patient Gateway (PG)	1,2,4,5, Medication list	PHR	Cross-sectional Analysis	43% portal adoption rate, lower adoption rate was noted among ethnic minority and lower income patients, however among portal users no disparities were noted. Portal marketing strategies employed: automated greetings into practice's telephone system, posters in waiting areas and exam rooms, postcard/letter mailings, staff in the office or over the phone & onsite enrollment with computer kiosk.

*data obtained from organization's web pages   https://www.nmff.org/aboutUs/newsstory.asp?id=334&page|NewsHome=1   https://secure2.nmff.org/Mychart/default.asp

**Assumed based of #12

Appendix, Figure 1

Figure 1: How "meaningful use" changes the healthcare experience for patients and families

Source: PwC Health Research Institute.