

Barriers to patient, provider, and caregiver adoption and use of electronic personal health records in chronic care: a systematic review

Zahra Niazkhani

Urmia University of Medical Sciences

Esmael Toni

Urmia University of Medical Sciences

Mojgan Cheshmekaboodi

Urmia University of Medical Sciences

Andrew Georgiou

Macquarie University

Habibollah Pimejad (✉ pimejad.h@umsu.ac.ir)

Urmia University of Medical Sciences <https://orcid.org/0000-0001-9284-5702>

Research article

Keywords: personal health records, systematic reviews, ePHR, self-care, chronic diseases

Posted Date: January 29th, 2020

DOI: <https://doi.org/10.21203/rs.2.22158/v1>

License: © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License. [Read Full License](#)

Version of Record: A version of this preprint was published on July 8th, 2020. See the published version at <https://doi.org/10.1186/s12911-020-01159-1>.

Abstract

Background

Existing evidence shows benefits of electronic personal health records (PHRs) in improving outcomes for chronic disease patients. However, its use has not been as widespread as expected. We aimed to review barriers to patient, provider, and caregiver adoption/use of PHRs in chronic disease care.

Methods

A systematic search in Medline, PubMed, Science Direct, Cumulative Index to Nursing and Allied Health Literature (CINAHL), the Cochrane Central Register of Controlled Trials, and the Institute of Electrical and Electronics Engineers (IEEE) database was performed to find original studies assessing barriers to PHR adoption/use in chronic care till the end of 2018. Two researchers independently screened and extracted data. We used the PHR adoption model and the Unified Theory of Acceptance and Use of Technology to analyze the results. The mixed methods appraisal tool (MMAT) version 2018 was used to assess the quality of evidence in included studies.

Results

Sixty publications met our inclusion criteria. Issues found hindering PHR adoption/use in chronic disease care were associated with demographic factors (e.g., patient age and gender) along with key variables related to health status, computer literacy, preferences for direct communication, and patient's strategy for coping with a chronic condition; as well as factors related to medical practice/environment (e.g., providers' lack of interest or resistance to adopting PHRs due to workload, lack of reimbursement, and lack of user training); technological (e.g., concerns over privacy and security, interoperability with electronic health record systems, and lack of customized features for chronic conditions); and chronic disease characteristics (e.g., multiplicities of co-morbid conditions, settings and providers involved in chronic care).

Conclusions

PHRs can be meaningfully used in chronic disease care if they are implemented as a component of comprehensive care models specifically developed for this care. Our results provide insight into hurdles and barriers mitigating PHR adoption/use in chronic disease care. Deeper understating of the interplay between these barriers will provide opportunities that can lead to an enhanced PHR adoption/use in chronic disease care.

1. Background

Promoting self-care and patient engagement in care management have gradually become key features in efforts to improve health service delivery and care quality in chronic diseases (1, 2). Electronic personal health records (PHRs) provide the tools to empower patients and promote self-care (3, 4). A systematic review found that self-monitoring through PHR improves health outcomes in chronic conditions (5). Because of this potential to enhance quality and patient engagement (6-8), the Health Information Technology for Economic and Clinical Health Act (HITECH) and meaningful use phase 2 and 3 have driven the adoption of PHRs in parallel to electronic health records (EHRs) (9).

Studies have shown that both patients and providers are interested in PHRs especially as they find them as a means to increase patient empowerment (10-12). Yet, there are barriers to overcome and challenges to embrace when adopting PHRs. Some of these barriers are related to the implementation of EHRs such as EHR products and capital and human resource issues. For example, from 2,674 general hospitals studied in the United States (US) in 2013, only 5.8 percent of hospitals met measures for stage 2 meaningful-use readiness and several other criteria, including sharing care summaries with other providers and providing patients with online access to their data, as necessary functions for a tethered PHR (13). Other barriers are more PHR specific ones such as poorly aligned functionalities with patients' expectations and self-management practices and concerns about privacy and confidentiality of patient information in PHRs (14-16). Even outside the US healthcare context, similar hurdles have also contributed to smaller adoption rates than what have been expected or hoped for (17). Therefore, recognizing and understanding the nature of such barriers is imperative for managing them and achieving PHR's meaningful use.

There have been a few reviews published on the barriers to PHR adoption and use. A review of the *patient* level barriers categorized them into individual, demographic, capability, health-related, PHR-related or attitudinal factors (18). Another review with similar scope concluded that a lack of awareness of and/or sufficient training regarding portal use were the two main barriers (19). In the elderly population, main barriers were limited technology access and no prior knowledge of the existence of a patient portal, and limited health literacy and motivation to use a patient portal (20). In rural areas of the US, provider resistance, privacy concerns, and the lack of EHRs, interoperability standards and funding were emerged as the main barriers (21). However, these reviews have narrowly focused on *patient* level barriers (18, 19), or were limited in terms of age ranges (20), time frame or geographical location reviewed (21, 22). To our knowledge, there is a significant gap in the literature on the barriers in patient, caregiver, and provider levels that may impact PHR adoption and use in the context of *chronic care*. To address this gap, we aimed to identify and synthesize evidence on PHR adoption and use barriers in chronic disease care. The insights gained will inform efforts for effective design, implementation and use of PHRs for a patient population at most need of these tools.

2. Methods

This review was conducted according to the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) (23).

2.1. Search strategy

We conducted a literature search in OVID versions of MEDLINE, PubMed, Science Direct, Cumulative Index to Nursing and Allied Health Literature (CINAHL), the Cochrane Central Register of Controlled Trials and the IEEE database for English-language, journal or congress proceedings' full texts published January 1,

2005 till December 31, 2018. We used a Boolean search strategy using key words and MeSH terms related to two areas of interest i.e., the intervention (e.g., Personal Health Record OR Personal Medical Record OR patient portal OR patient internet portal, etc.) *AND* the health condition (e.g., Chronic Disease OR Chronic Illness, OR Chronic Condition, etc.). The details of our search strategy are accessible in Appendix A. We also conducted a manual review of all reference lists of included studies and the pertinent PHR reviews including (14, 15, 18-22, 24-29).

2.2. Inclusion and exclusion criteria

We included studies according to the following inclusion criteria: 1) the intervention was an electronic PHR/patient portal, 2) the targeted users were *chronic* disease patients, their caregivers and/or their healthcare professionals, 3) the study was an original research article, and 4) the study design was either quantitative, qualitative, or mixed methods.

We excluded PHR/patient portals that were not aimed at chronic patients, paper-based PHRs or educational websites, assistive living technologies, or mHealth tools, systematic reviews, proceedings abstracts, commentaries, editorials, and articles describing theoretical background or design reports without having an evaluation nature. Main reasons for exclusions in each phase of this review are accessible in Appendix B.

2.3. Review procedures and data extraction

After removing duplicates, our search identified 3088 unique records, which were screened for eligibility. Figure 1 shows the PRISMA flow diagram of our review. Three authors screened titles and abstracts to find relevant studies based on our inclusion/exclusion criteria. In this phase, 143 potentially eligible publications were selected for the full text review. Further articles were found through the manual review. All articles were independently reviewed in detail by ZN and either ET or MK. Disagreements were solved by consensus. Endnote version XI was used to manage records.

We extracted the following main study characteristics in the full review phase: general information (e.g., the authors and publication year), study objectives, study design, patient population, system users, the intervention (e.g., the description of PHRs and their integration with other systems), and the main study results.

2.4. The methodological quality of studies

We used the mixed methods appraisal tool (MMAT) version 2018 to assess the quality of evidence in included studies (30). This tool can be used to appraise the quality of empirical studies (i.e., primary research based on experiment, observation or simulation) in three categories of study designs (i.e., qualitative, quantitative and mixed methods).

2.5. Data synthesis

According to a widely used definition, a PHR is “an electronic application through which individuals can access, manage and share their health information, and that of others for whom they are authorized, in a private, secure, and confidential environment” (3). We used two well-known models as a theoretical background to analyze and categorize barriers to PHR adoption/use faced by users. The first was the “Personal Health Records Adoption Model” (PHRAM), developed through integrating several relevant parent models/theories (31). This model was used to analyze the barriers faced by patients and caregivers in the context of chronic care. We also used the unified theory of acceptance and use of technology (UTAUT) to analyze barriers specifically experienced by care providers (32). Since conducting a meta-analysis was out of the scope of this study, we only provide a narrative description of results on the basis of the PHRAM and UTAUT.

3. Results

3.1. Characteristics of included studies

Our review identified 60 PHR studies (5, 12, 33-90), among which 24 were qualitative, 22 quantitative, and 14 mixed methods studies. Table 1 provides the details of included studies. These studies were conducted between 2006 and 2018, nine of them in a single year of 2015. Forty-six studies were from the US, followed by five studies in Canada, two studies in the Netherlands, two in the United Kingdom, and the remaining five in Denmark, Sweden, Germany, New Zealand, and Argentina (one study from each country). A majority of studies included older patient populations (compared with younger patients) and diabetics (compared to other chronic patients) in their evaluations. Ten studies had a target population of pediatrics (37-39, 43, 44, 60, 72, 73, 79, 86). The results are provided here according to the personal, environmental/medical practice, technological and chronic disease factors on the bases of the PHRAM and UTAUT.

3.2. Personal factors

In one study involving survivors of pediatric cancers, referring to the issue of age, cancer survivors >18 years old were significantly more likely to use a PHR compared to those <18 (86). While a high proportion of patients with age 50 and older had higher frequency and intensity of PHR use (67), patients over the age of 65 were less likely to intend to use a PHR (49), and patients aged over 70 were associated with a lack of use (71). In four studies, more men than women had access to computers or the internet, expressed confidence in using PHRs, or used it (55, 68, 75, 85), while females were the dominant users in three studies (48, 67, 90).

People with minority race/ethnicity (including African-American, Latino, and Filipino) reported more negative attitudes towards PHRs, were less likely to use PHRs, and experienced more obstacles compared to Whites and Caucasians (34, 47, 48, 56, 58, 62, 66, 67, 70, 71, 75, 76, 86). Having a paid job or higher

income and living in higher socioeconomic neighborhood, and being insured were associated with higher use (42, 62, 67, 68, 76, 85), while lower income and being below poverty level were linked to non-use (34, 48).

Patients with lower educational attainments were less likely to intend to use or actually use a PHR (34, 42, 48, 49, 62, 66, 68, 70, 71, 75, 76). Patients with limited health literacy were less likely to use PHR or use it ineffectively (5, 34, 41, 46, 55, 66, 70, 75, 77, 78, 88). The level of knowledge, self-efficacy and confidence in technology use were associated to PHR adoption/use (53, 55, 57, 68, 84).

Negative attitudes toward the disease and health care experiences in general, and PHRs in particular, prevented patients from using PHRs (40, 44, 47, 49, 60, 72). Patients were concerned about the reliability of PHRs to facilitate a timely and productive communication with providers (37, 43, 66, 82). In one study, patients commonly expressed negative attitudes partly because of their experience of confusion and misunderstanding (40).

Fourteen studies highlighted the critical role of computer/technology literacy and skills to effectively use PHRs (5, 41, 42, 45, 50, 53, 57, 66, 69, 77, 83, 84, 87, 88). Computer literacy barriers included, but not limited to, the lack of basic computer skills, inexperience in using search bars or uniform resource locators, difficulty while navigating the portal, and negative experiences with online security breaches/viruses. Three studies noted that computer anxiety negatively affected patients' behavioral intention to adopt PHRs (5, 34, 87).

Challenges related to communication preferences were brought up in a number of studies with a majority pointing out the value of in person, or telephone contacts between patients and providers (37-40, 44, 47, 48, 50, 53, 59, 60, 65, 66, 77, 79-81, 83, 87). The main reasons for such a preference were getting anxious/frightened when seeing results online and concerns over technology replacing their providers. The preference for in-person communications was also shared by providers in certain circumstances (65, 81).

3.3. Environmental/medical practice factors

3.3.1. Social influence

The impact of social influence of "important others" (i.e., family members and care providers) on patients was evident (12, 55, 56). It was shown that living alone and being not currently married were associated to non-adoption and lesser PHR use (34, 42, 68). Moreover, studies pointed out the role of providers' willingness to use portals, their communication about it, and their level of use in patients' initial portal use (47, 60, 82, 85). While patients wanted their physicians to get more involved in PHRs (80), physicians viewed them as a more of a patient, receptionist, or nurses tool (69, 80).

3.3.2. Facilitating/impending conditions

Our review identified the existence, or otherwise lack, of the following organizational and/or technical infrastructures to support or impede PHR use: being in an organization's priority list, integration into the EHRs, patients ready access to resources such as computers, the Internet, and PHRs, adequate technical support, and proper training on PHR use (5, 12, 34, 42, 46, 49, 51-53, 57, 61, 65, 66, 77, 85, 89).

Due to its impacts on physician's time management and workload, "physician resistance" was mentioned as "the greatest barrier to PHR implementation" (12). There were also concerns about the impacts on providers' available time for care, lack of reimbursement, or professional liability issues (36, 65, 69). Physicians voiced their concerns about excess time and efforts to handle issues related to the PHRs due to lack of integration with EHRs (80, 81).

3.3.3. Incentive motivation

Tangible incentives and cost compensations, or otherwise lack thereof, were also an important factor (12, 55, 65, 66). For example, it was important to be certain on how PHR-related services would be paid for, who would pay and under what circumstances (41). Cost of services was also mentioned as a barrier by patients (77, 84, 89).

3.4. Technology factors

This section provides the results related to the perceived usefulness of PHRs, perception of external control, compatibility, and perceived complexity.

3.4.1. Perceived usefulness

Perceived usefulness featured as a key driving factor for the intention to use PHRs (49, 50, 60, 66, 80, 81). For example, non-users mostly expressed concerns about simply not seeing the value of using a portal to manage their health or lack of personalization in using this technology (66).

3.4.2. Perception of external control

Preserving general privacy, confidentiality, and security of health records were one of the most common concerns regarding PHR use (e.g., confidentiality of a stigmatized or sensitive condition, or confidentiality and security of information easily accessible to researchers and industry members, and misuse of information by insurance companies to deny coverage) (45-47, 49, 53, 59, 66, 69, 73, 77, 79, 88, 89). Patients voiced their concerns about caregiver's access to their information and requested for appropriate access limitation (53, 54, 69). Clinicians' attitudes towards caregiver involvement in PHR use was controversial in one study: while 28.3% favored it, 32.1% disagreed because it impaired patients' privacy (81).

Moreover, patients reported frustration at a number of instances in which their profile, medication list, lab results or medical history were incorrect or missing in the PHR but they were unable to correct them (46, 51, 65).

3.4.3. Compatibility

The degree to which a PHR was perceived as being consistent with the existing values, past experiences, and needs of its potential adopters i.e., chronic patients and their caregivers and providers was mentioned as an important factor for adoption in a number of studies (36, 40, 44, 65, 91). When comparing with the traditional chronic care, users asked for much easier navigation through PHRs, access to additional information (e.g., progress notes, outside test results, personalized medication information, and a structure to track the course of treatment) or a customized PHR based on their specific chronic illness (36, 39, 41, 44, 46, 51, 61, 63, 79, 81).

3.4.4. Perceived complexity

Difficulty of understanding or navigating a PHR were one of the most common barriers referred to in the included studies. Use of problematic medical jargon, confusing information display, and unclear presentation of information based on patients' knowledge (e.g., unclear numeral values and unfamiliar medical terms) were only some of the barriers that prevented effective PHR use (33, 35, 38-41, 46, 50, 51, 60, 61, 69, 77, 79, 80, 83).

3.5. Characteristics of chronic disease

3.5.1. Attitudes on negotiated collaboration and preferences for self-regulation

On the one hand, the feeling of having more control on the disease was a reason for limited portal use by patients (34, 60, 80). Providers also doubted whether patients who were proficient at monitoring their disease were the right group to benefit from PHRs (80). On the other hand, being an active healthcare consumer and having a worse or higher proportion of co-morbid conditions and taking more prescribed medications were linked to PHR use (34, 45, 55, 67, 85, 90). It was also noted that patients' willingness to take responsibility for their health through PHR depended on their coping style and perceived competence and autonomy (72). In a study, patients who "felt too confronted when monitoring the course of their illness" dropped out of a PHR (81).

3.5.2. Perceived complexity of care

On the basis of the task-technology-fit model, a study found instances of mismatches between user mental models and the technology, which manifested primarily as vocabulary misunderstandings, as portal functionality that did not perform as the patient expected, and as requests for clarification and help (33). In fact, they did not have a very concrete understanding of how health information management tasks and processes underlying the PHR worked.

3.5.3. Characteristics of healthcare settings, providers, and chronic illnesses

In one study, patients at rural settings were less likely to use PHRs compared with those in urban settings (34). However, if patients received care at multiple sites, they were more likely to use PHRs. Patients acknowledged the need to consolidate data produced by multiple providers, and scattered in different locations through PHRs (33). A lack of interoperability between PHRs and EHRs in provider offices was noted in three studies resulting in excess workload and frustration (46, 51, 92). In a survey of patients from 29 states across the US, with at least 38 different types of portals, 51% reported having two or more portal accounts creating frustration when it came to patients remembering their names, and managing different portals from different providers (57). This was a concern in another study, too (66).

Another problem was confusion over who should receive and reply to messages on the provider team i.e., a physician, a nurse, the office staff, or the entire care team; because this would impact the content of patient messages (37, 46, 87). In another study, patients had unsatisfactory communications with care team through a portal; for example, they failed to track their health issues in a coherent ways (43). Physicians were concerned about clarity about responsibilities (and potential liabilities) related to responding to patient-added information or commentaries seen by a number of different clinicians (36). For the sake of clarity, Table 2 provides a summary of provider-specific barriers.

3.6. Methodological quality of included studies

Appendix C provides the results of quality check for included studies. There were some quality issues mainly about data collection and interpretation in four studies (5, 88-90). Because the MMAT discourages excluding studies based on methodological quality, we did include all 60 identified studies in our analysis and report.

4. Discussion

Understanding barriers that prevent realizing the PHR' full benefits is a prerequisite to future work aimed at its optimal use. Our comprehensive review identified 60 relevant studies, which identified barriers to PHR adoption/use associated to the interacting factors of personal, environmental/medical practice, technology and chronic condition. Our findings expand on those of earlier reviews (18, 19) and point out that our knowledge base for this topic is still limited (and one dimensional), with most of the research predominantly focusing on facilitators than barriers and also on barriers at the patient level than those existed beyond patient level.

Differences among users of health information technology (HIT) and the implication of their needs and requirements for design and development have recently gained further attention (93-96). PHRs are aiming to empower *patients* and/or *caregivers* and engage them in a collaborative and productive chronic care with *health professionals*. Failure to acknowledge the characteristics, needs and requirements of all these user groups will lead to development of unpredictable barriers to PHR adoption leading to its sub-optimal use. In line with the previous literature, our findings highlight the impact of "digital divide" at the patient level (in terms of age, gender, health and technology literacy and socioeconomic status) and a number of attitudinal factors such as copying styles with a chronic condition (e.g., denial of a condition) and preferences for personal communications with care providers (e.g., preference for direct contact) (18, 97, 98). Our review also points out that the literature has heavily focused on the elderly, probably because they are disproportionately represented among patients with chronic diseases. Thus, it is plausible that the barriers faced by the younger and also middle-aged (<50 years old) chronic patients would be

under recognized and PHR use in these groups may fall behind. This is particularly important because of the increasing prevalence of chronic diseases such as diabetes in these age groups. These groups increasingly represent users with higher educational levels and technology literacy (with higher needs and expectations), compared with that of elderly, introducing a niche market for PHRs and a unique opportunity to tap their potential.

With PHRs, the responsibilities of patients and providers are changed in a number of ways. For example, they need to make sure that the data available in different locations are accurate, integrated, and updated (3). This is important particularly because data about chronic care is scattered throughout different EHRs that do not speak together; and then, the task of data integration is informally delegated to patients. PHRs can be meaningfully used if they are implemented as a component (i.e., a tool for self-management) of comprehensive care models developed for chronic care (such as the Wagner's Chronic Care Model (99)). If such models are implemented and proper links are made between their components (i.e., self-management, clinical information systems, disease registries, and decision support systems), patients are freed from extra responsibilities, and are able to focus on productive "self-management" through an ongoing collaborative processes with their providers via PHRs. Therefore, as the adoption of PHRs are very related to the adoption of EHRs, the barriers related to EHRs in the first place and then the interoperability between these two should adequately be addressed (16, 21, 27). Unfortunately, discussion on such issues has been underrepresented in the identified studies, which should be taken into account in future research.

Our review shows that the barriers related to the providers and the organization of chronic care have not fully been studied despite their importance (studied by only 8 studies). The lack of provider interest and even their resistance to adopt PHRs are important (3, 12, 21, 100). Provider concerns about the impacts on workload, professional/legal liabilities, relationships with patients, and the lack of reimbursements should be fully addressed (14, 21, 101, 102). Moreover, their involvement in PHR use has not been given a full attention as it deserves. In a review of 19 PHRs, only half had enabled user actions taken by *physicians* (16). Providers can act as an effective catalyst in this regard by practicing their social influence on patients (103). Scholars have highlighted that without involving providers in PHR's design, implementation and application and without addressing their barriers, efforts for widespread PHR adoption/use would be in vain (3, 104, 105). Therefore, it will be insightful if future studies explore in more depth provider issues and how they can further be engaged with this emerging technology in chronic care.

Functionalities of PHRs that provide solutions for personalized needs and requirements of chronic patients have important implications for their adoption and use, as also emerged in our review (16, 18, 74, 91, 106). One review suggested that features such as access to personal health data and general health information, communicating with providers and support groups, and receiving personal decision support were linked to empirical evidence of benefits from PHR-enabled self-management (18). Yet, no PHR in that review described a platform for all those features. Furthermore, the necessity for measures to ensure the privacy and confidentiality in record transactions and communication through PHRs was a serious concern voiced by clinical directors and health information technology leaders, besides patients (12, 45, 47, 49, 53, 59, 66, 69, 73, 77, 79, 81). The relevancy of this concern has also been highlighted elsewhere (20, 21, 27, 97, 107). Reviewing privacy policies of 24 PHRs showed that such concerns are very relevant and that compliance with privacy standards and regulations were generally low (15). It has been recommended that institutions should assemble governance groups to develop policies regarding security, privacy and confidentiality of records in order to assure PHR users on preserving their rights (12).

4.1. Strengths and weaknesses of our review

To our knowledge, no study to date has analyzed PHR studies exclusively with respect to barriers to its adoption and use in *chronic care*. Nevertheless, our review has several limitations. First of all, we only included studies published in English. Second, facilitators and barriers to the adoption of a technology is a complex concept without an agreed upon research methodology. It is plausible that many of the discussions about these core concepts have appeared only in non peer-reviewed or research publications such as white papers, perspectives, editorials, etc. The findings of our systematic review are confined by the content of included articles, and hence may not well reflect a proper balance of what is known on the topic. Such reviews however point out the gaps and direct future studies. Third, PHRs are an evolving technology with new features and functionalities and so is their position in chronic care. Therefore, it is possible that barriers identified in this review cannot be generalizable to all patient populations or different implementation strategies and healthcare systems. For example, a majority of studies are from the US and therefore a Western viewpoint is predominant here. Therefore, it should be born in mind that the barriers faced by users might be different in different healthcare contexts.

5. Conclusion

If we are to reap the full benefits of PHRs in chronic care, we ought to understand barriers to their adoption and sustained use. Deeper understating of these barriers will reveal opportunities that if addressed can lead to an enhanced use of PHR. Future research must aim at identifying the barriers experienced by younger chronic patients and their requirements and expectations, and also those barriers faced by providers all beyond patient level.

Abbreviations

PEHR: Electronic personal health records

CINAHL: Cumulative Index to Nursing and Allied Health Literature

IEEE: Institute of Electrical and Electronics Engineers

HITECH: Health Information Technology for Economic and Clinical Health Act

EHRs: Electronic health records

US: The United States

PRISMA: Preferred Reporting Items for Systematic reviews and Meta-Analyses

MMAT: Mixed methods appraisal tool

PHRAM: Personal Health Records Adoption Model"

UTAUT: Unified theory of acceptance and use of technology

HIT: Health information technology

UUMS: Urmia University of Medical Sciences

Declarations

Ethics approval and consent to participate

Not applicable.

Consent to publish

Not applicable.

Availability of data and materials

All data generated or analysed during this systematic review are included in this published article [and its supplementary information files].

Competing interests

None

Funding

This study was part of a Master of Science thesis in medical informatics domain of the second author funded partially by Urmia University of Medical Sciences (UUMS) (registered number 2952). It did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. UUMS had no role in the design of the study and collection, analysis, and interpretation of data as well as in writing the manuscript

Authors' contributions

ZN, ET, MCK and HP designed the study and the search strategy. ET conducted the systematic search. ZN, ET and MCK screened the titles and abstracts and reviewed full texts of articles and extracted data. ZN wrote the early version and revised it according to ET, MCK, AG and HP' comments. ET, MCK, AG and HP contributed in the interpretation of the results. HP conducted the quality check of the included studies. ZN, ET, MCK, AG and HP read and approved the final version.

Acknowledgement

Not applicable

Additional Materials

Supplementary material_appendix A: The search strategy in the electronic databases used in our study

Supplementary material _appendix B: The main reasons for exclusion of articles

Supplementary material_appendix C: Quality of included studies by the MMAT tool

References

1. Ausili D, Masotto M, Dall'Ora C, et al. A literature review on self-care of chronic illness: definition, assessment and related outcomes. *Professioni infermieristiche*. 2014 Jul-Sep;67(3):180-9. PubMed PMID: 25392031.
2. Kennedy A, Rogers A, Bower P. Support for self care for patients with chronic disease. *Bmj*. 2007 Nov 10;335(7627):968-70. PubMed PMID: 17991978. Pubmed Central PMCID: 2071971.
3. Tang PC, Ash JS, Bates DW, et al. Personal health records: definitions, benefits, and strategies for overcoming barriers to adoption. *Journal of the American Medical Informatics Association : JAMIA*. 2006 Mar-Apr;13(2):121-6. PubMed PMID: 16357345. Pubmed Central PMCID: 1447551.
4. Tenforde M, Jain A, Hickner J. The value of personal health records for chronic disease management: what do we know? *Family medicine*. 2011 May;43(5):351-4. PubMed PMID: 21557106.
5. Lober WB, Zierler B, Herbaugh A, et al. Barriers to the use of a personal health record by an elderly population. *AMIA Annual Symposium proceedings AMIA Symposium*. 2006:514-8. PubMed PMID: 17238394. Pubmed Central PMCID: 1839577.

6. Keith McInnes D, Shimada SL, Rao SR, et al. Personal health record use and its association with antiretroviral adherence: survey and medical record data from 1871 US veterans infected with HIV. *AIDS and behavior*. 2013 Nov;17(9):3091-100. PubMed PMID: 23334359.
7. Martinez Nicolas I, Le Cook B, Flores M, et al. The impact of a comprehensive electronic patient portal on the health service use: an interrupted time-series analysis. *European journal of public health*. 2018 Dec 12. PubMed PMID: 30544169.
8. Sorondo B, Allen A, Fathima S, et al. Patient Portal as a Tool for Enhancing Patient Experience and Improving Quality of Care in Primary Care Practices. *Egms*. 2016;4(1):1262. PubMed PMID: 28203611. Pubmed Central PMCID: 5302860.
9. Pipersburgh J. The push to increase the use of EHR technology by hospitals and physicians in the United States through the HITECH Act and the Medicare incentive program. *Journal of health care finance*. 2011 Winter;38(2):54-78. PubMed PMID: 22372032.
10. Harrison TG, Wick J, Ahmed SB, et al. Patients with chronic kidney disease and their intent to use electronic personal health records. *Canadian journal of kidney health and disease*. 2015;2:23. PubMed PMID: 26075082. Pubmed Central PMCID: PMC4465011. Epub 2015/06/16. eng.
11. Kruse CS, Argueta DA, Lopez L, et al. Patient and provider attitudes toward the use of patient portals for the management of chronic disease: a systematic review. *Journal of medical Internet research*. 2015 Feb 20;17(2):e40. PubMed PMID: 25707035. Pubmed Central PMCID: 4376181.
12. Wells S, Rozenblum R, Park A, et al. Organizational strategies for promoting patient and provider uptake of personal health records. *Journal of the American Medical Informatics Association : JAMIA*. 2015 Jan;22(1):213-22. PubMed PMID: 25326601. Pubmed Central PMCID: PMC4433381. Epub 2014/10/19. eng.
13. Adler-Milstein J, DesRoches CM, Furukawa MF, et al. More than half of US hospitals have at least a basic EHR, but stage 2 criteria remain challenging for most. *Health affairs*. 2014 Sep;33(9):1664-71. PubMed PMID: 25104826.
14. Lester M, Boateng S, Studeny J, et al. Personal Health Records: Beneficial or Burdensome for Patients and Healthcare Providers? Perspectives in health information management. 2016;13:1h. PubMed PMID: 27134613. Pubmed Central PMCID: 4832132.
15. Carrion Senior I, Fernandez-Aleman JL, Toval A. Are personal health records safe? A review of free web-accessible personal health record privacy policies. *Journal of medical Internet research*. 2012 Aug 23;14(4):e114. PubMed PMID: 22917868. Pubmed Central PMCID: 3510685.
16. Fernandez-Aleman JL, Seva-Llor CL, Toval A, et al. Free Web-based personal health records: an analysis of functionality. *Journal of medical systems*. 2013 Dec;37(6):9990. PubMed PMID: 24221916.
17. Greenhalgh T, Hinder S, Stramer K, et al. Adoption, non-adoption, and abandonment of a personal electronic health record: case study of HealthSpace. *Bmj*. 2010 Nov 16;341:c5814. PubMed PMID: 21081595. Pubmed Central PMCID: 2982892.
18. Price M, Bellwood P, Kitson N, et al. Conditions potentially sensitive to a personal health record (PHR) intervention, a systematic review. *BMC medical informatics and decision making*. 2015 Apr 18;15:32. PubMed PMID: 25927384. Pubmed Central PMCID: 4411701.
19. Powell KR. Patient-Perceived Facilitators of and Barriers to Electronic Portal Use: A Systematic Review. *Computers, informatics, nursing : CIN*. 2017 Nov;35(11):565-73. PubMed PMID: 28723832.
20. Wildenbos GA, Peute L, Jaspers M. Facilitators and Barriers of Electronic Health Record Patient Portal Adoption by Older Adults: A Literature Study. *Studies in health technology and informatics*. 2017;235:308-12. PubMed PMID: 28423804.
21. Hargreaves JS. Will electronic personal health records benefit providers and patients in rural America? *Telemedicine journal and e-health : the official journal of the American Telemedicine Association*. 2010 Mar;16(2):167-76. PubMed PMID: 20082592.
22. Vance B, Tomblin B, Studeny J, et al. Benefits and barriers for adoption of personal health records. the 51st Annual Midwest Business Administration Association International Conference; March 2015; Chicago, IL 2015.
23. Moher D, Liberati A, Tetzlaff J, et al. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS medicine*. 2009 Jul 21;6(7):e1000097. PubMed PMID: 19621072. Pubmed Central PMCID: 2707599.
24. Thompson MJ, Reilly JD, Valdez RS. Work system barriers to patient, provider, and caregiver use of personal health records: A systematic review. *Applied ergonomics*. 2016 May;54:218-42. PubMed PMID: 26851482.
25. Archer N, Fevrier-Thomas U, Lokker C, et al. Personal health records: a scoping review. *Journal of the American Medical Informatics Association : JAMIA*. 2011 Jul-Aug;18(4):515-22. PubMed PMID: 21672914. Pubmed Central PMCID: 3128401.
26. Ko H, Turner T, Jones C, et al. Patient-held medical records for patients with chronic disease: a systematic review. *Quality & safety in health care*. 2010 Oct;19(5):e41. PubMed PMID: 20511601.
27. Roehrs A, da Costa CA, Righi RD, et al. Personal Health Records: A Systematic Literature Review. *Journal of medical Internet research*. 2017 Jan 6;19(1):e13. PubMed PMID: 28062391. Pubmed Central PMCID: 5251169.
28. Bouayad L, Ialynytchev A, Padmanabhan B. Patient Health Record Systems Scope and Functionalities: Literature Review and Future Directions. *Journal of medical Internet research*. 2017 Nov 15;19(11):e388. PubMed PMID: 29141839. Pubmed Central PMCID: 5707430.
29. Coughlin SS, Prochaska JJ, Williams LB, et al. Patient web portals, disease management, and primary prevention. *Risk management and healthcare policy*. 2017;10:33-40. PubMed PMID: 28435342. Pubmed Central PMCID: 5391175.
30. Hong QN, Pluye P, Fabregues S, et al. Improving the content validity of the mixed methods appraisal tool: a modified e-Delphi study. *Journal of clinical epidemiology*. 2019 Mar 22. PubMed PMID: 30905698.
31. Logue MD, Effken JA. Modeling factors that influence personal health records adoption. *Computers, informatics, nursing : CIN*. 2012 Jul;30(7):354-62. PubMed PMID: 22525046.
32. Venkatesh V, Morris MG, Davis GB, et al. User Acceptance of Information Technology: Toward a Unified View. *MIS Quarterly*. 2003;27(3):425-78
33. Ali SB, Romero J, Morrison K, et al. Focus Section Health IT Usability: Applying a Task-Technology Fit Model to Adapt an Electronic Patient Portal for Patient Work. *Applied clinical informatics*. 2018 Jan;9(1):174-84. PubMed PMID: 29539648. Pubmed Central PMCID: PMC5851788. Epub 2018/03/15.

eng.

34. Arcury TA, Quandt SA, Sandberg JC, et al. Patient Portal Utilization Among Ethnically Diverse Low Income Older Adults: Observational Study. *JMIR medical informatics*. 2017 Nov 14;5(4):e47. PubMed PMID: 29138129. Pubmed Central PMCID: PMC5705857. Epub 2017/11/16. eng.
35. Barron J, Bedra M, Wood J, et al. Exploring three perspectives on feasibility of a patient portal for older adults. *Studies in health technology and informatics*. 2014;202:181-4. PubMed PMID: 25000046. Epub 2014/07/08. eng.
36. Baudendistel I, Winkler E, Kamradt M, et al. Personal electronic health records: understanding user requirements and needs in chronic cancer care. *Journal of medical Internet research*. 2015 May 21;17(5):e121. PubMed PMID: 25998006. Pubmed Central PMCID: PMC4468571. Epub 2015/05/23. eng.
37. Britto MT, Hesse EA, Kamdar OJ, et al. Parents' perceptions of a patient portal for managing their child's chronic illness. *The Journal of pediatrics*. 2013 Jul;163(1):280-1.e1-2. PubMed PMID: 23541773. Epub 2013/04/02. eng.
38. Britto MT, Jimison HB, Munafo JK, et al. Usability testing finds problems for novice users of pediatric portals. *Journal of the American Medical Informatics Association : JAMIA*. 2009 Sep-Oct;16(5):660-9. PubMed PMID: 19567793. Pubmed Central PMCID: PMC2744717. Epub 2009/07/02. eng.
39. Byczkowski TL, Munafo JK, Britto MT. Family perceptions of the usability and value of chronic disease web-based patient portals. *Health informatics journal*. 2014 Jun;20(2):151-62. PubMed PMID: 24056751. Epub 2013/09/24. eng.
40. Cerdan J, Catalan-Matamoros D, Berg SW. Online communication in a rehabilitation setting: Experiences of patients with chronic conditions using a web portal in Denmark. *Patient education and counseling*. 2017 Dec;100(12):2283-9. PubMed PMID: 28698033. Epub 2017/07/13. eng.
41. Day K, Gu Y. Influencing factors for adopting personal health record (PHR). *Studies in health technology and informatics*. 2012;178:39-44. PubMed PMID: 22797017. Epub 2012/07/17. eng.
42. Emani S, Yamin CK, Peters E, et al. Patient perceptions of a personal health record: a test of the diffusion of innovation model. *Journal of medical Internet research*. 2012 Nov 5;14(6):e150. PubMed PMID: 23128775. Pubmed Central PMCID: 3517342.
43. Eschler J, Meas PL, Lozano P, et al. Integrating the patient portal into the health management work ecosystem: user acceptance of a novel prototype. *AMIA Annual Symposium proceedings AMIA Symposium*. 2016;2016:541-50. PubMed PMID: 28269850. Pubmed Central PMCID: PMC5333335. Epub 2017/03/09. eng.
44. Fiks AGMDM, Mayne SMHS, Karavite DJMSI, et al. A Shared e-Decision Support Portal for Pediatric Asthma. [Article]: *Journal of Ambulatory Care Management* April/June 2014;37(2):120-126; 2014.
45. Gartrell K, Storr CL, Trinkoff AM, et al. Electronic personal health record use among registered nurses. *Nursing outlook*. 2015 May-Jun;63(3):278-87. PubMed PMID: 25982768. Pubmed Central PMCID: PMC4438260. Epub 2015/05/20. eng.
46. Gee PM, Paterniti DA, Ward D, et al. e-Patients Perceptions of Using Personal Health Records for Self-management Support of Chronic Illness. *Computers, informatics, nursing : CIN*. 2015 Jun;33(6):229-37. PubMed PMID: 25899440. Epub 2015/04/23. eng.
47. Goel MS, Brown TL, Williams A, et al. Patient reported barriers to enrolling in a patient portal. *Journal of the American Medical Informatics Association : JAMIA*. 2011 Dec;18 Suppl 1:i8-12. PubMed PMID: 22071530. Pubmed Central PMCID: PMC3241181. Epub 2011/11/11. eng.
48. Graetz I, Gordon N, Fung V, et al. The Digital Divide and Patient Portals: Internet Access Explained Differences in Patient Portal Use for Secure Messaging by Age, Race, and Income. *Medical care*. 2016 Aug;54(8):772-9. PubMed PMID: 27314262. Epub 2016/06/18. eng.
49. Harrison TG, Wick J, Ahmed SB, et al. Patients with chronic kidney disease and their intent to use electronic personal health records. *Canadian journal of kidney health and disease*. 2015;2:23. PubMed PMID: 26075082. Pubmed Central PMCID: PMC4465011. Epub 2015/06/16. eng.
50. Hazara AM, Bhandari S. Barriers to patient participation in a self-management and education website Renal PatientView: A questionnaire-based study of inactive users. *International journal of medical informatics*. 2016 Mar;87:10-4. PubMed PMID: 26806707. Epub 2016/01/26. eng.
51. Hess R, Bryce CL, Paone S, et al. Exploring challenges and potentials of personal health records in diabetes self-management: implementation and initial assessment. *Telemedicine journal and e-health : the official journal of the American Telemedicine Association*. 2007 Oct;13(5):509-17. PubMed PMID: 17999613. Epub 2007/11/15. eng.
52. Kim EH, Stolyar A, Lober WB, et al. Challenges to using an electronic personal health record by a low-income elderly population. *Journal of medical Internet research*. 2009 Oct 27;11(4):e44. PubMed PMID: 19861298. Pubmed Central PMCID: 2802566.
53. Latulipe C, Gatto A, Nguyen HT, et al. Design Considerations for Patient Portal Adoption by Low-Income, Older Adults. *Proceedings of the SIGCHI conference on human factors in computing systems CHI Conference*. 2015 Apr;2015:3859-68. PubMed PMID: 27077140. Pubmed Central PMCID: PMC4827765. Epub 2016/04/15. eng.
54. Latulipe C, Quandt SA, Melius KA, et al. Insights Into Older Adult Patient Concerns Around the Caregiver Proxy Portal Use: Qualitative Interview Study. *Journal of medical Internet research*. 2018 Nov 2;20(11):e10524. PubMed PMID: 30389654. Pubmed Central PMCID: PMC6240158. Epub 2018/11/06. eng.
55. Logue MD, Effken JA. An exploratory study of the personal health records adoption model in the older adult with chronic illness. *Informatics in primary care*. 2012;20(3):151-69. PubMed PMID: 23710840. Epub 2012/01/01. eng.
56. Lyles CR, Sarkar U, Ralston JD, et al. Patient-provider communication and trust in relation to use of an online patient portal among diabetes patients: The Diabetes and Aging Study. *Journal of the American Medical Informatics Association : JAMIA*. 2013 Nov-Dec;20(6):1128-31. PubMed PMID: 23676243. Pubmed Central PMCID: 3822118.
57. Nahm ES, Zhu S, Bellantoni M, Keldsen L, et al. Patient Portal Use Among Older Adults: What Is Really Happening Nationwide? *Journal of applied gerontology : the official journal of the Southern Gerontological Society*. 2018 May 1:733464818776125. PubMed PMID: 29779422. Epub 2018/05/22. eng.

58. Nielsen AS, Halamka JD, Kinkel RP. Internet portal use in an academic multiple sclerosis center. *Journal of the American Medical Informatics Association : JAMIA*. 2012 Jan-Feb;19(1):128-33. PubMed PMID: 21571744. Pubmed Central PMCID: 3240754.
59. Nippak PMD, Isaac WW, Geertsens A, et al. Family attitudes towards an electronic personal health record in a long term care facility. *Journal of Hospital Administration*. 2015;4(3):9-19.
60. Nordfeldt S, Hanberger L, Bertero C. Patient and parent views on a Web 2.0 Diabetes Portal—the management tool, the generator, and the gatekeeper: qualitative study. *Journal of medical Internet research*. 2010 May 28;12(2):e17. PubMed PMID: 20511179. Pubmed Central PMCID: PMC2956228. Epub 2010/06/01. eng.
61. Odium M, Gordon P, Camhi E, et al. Exploring factors related to the adoption and acceptance of an internet-based electronic personal health management tool (EPHMT) in a low income, special needs population of people living with HIV and AIDS in New York City. *Studies in health technology and informatics*. 2014;201:145-52. PubMed PMID: 24943537. Epub 2014/06/20. eng.
62. Osborn CY, Mayberry LS, Wallston KA, et al. Understanding patient portal use: implications for medication management. *Journal of medical Internet research*. 2013 Jul 3;15(7):e133. PubMed PMID: 23823974. Pubmed Central PMCID: 3713921.
63. Pai HH, Lau F, Barnett J, et al. Meeting the health information needs of prostate cancer patients using personal health records. *Current oncology (Toronto, Ont)*. 2013 Dec;20(6):e561-9. PubMed PMID: 24311957. Pubmed Central PMCID: PMC3851353. Epub 2013/12/07. eng.
64. Peremislov D. Patient Use of the Electronic Communication Portal in Management of Type 2 Diabetes. *Computers, informatics, nursing : CIN*. 2017 Sep;35(9):473-82. PubMed PMID: 28323648. Epub 2017/03/23. eng.
65. Electronic Patient Portals: Patient and Provider Perceptions [Internet]. 2018 [cited 15th, April 2008]. Available from: <http://www.himss.org/ojni>.
66. Price-Haywood EG, Harden-Barrios J, Ulep R, et al. eHealth Literacy: Patient Engagement in Identifying Strategies to Encourage Use of Patient Portals Among Older Adults. *Population health management*. 2017 Dec;20(6):486-94. PubMed PMID: 28384076. Epub 2017/04/07. eng.
67. Price-Haywood EG, Luo Q, Monlezun D. Dose effect of patient-care team communication via secure portal messaging on glucose and blood pressure control. *Journal of the American Medical Informatics Association : JAMIA*. 2018 Jun 1;25(6):702-8. PubMed PMID: 29444256. Epub 2018/02/15. eng.
68. Ronda MC, Dijkhorst-Oei LT, Gorter KJ, et al. Differences between diabetes patients who are interested or not in the use of a patient Web portal. *Diabetes technology & therapeutics*. 2013 Jul;15(7):556-63. PubMed PMID: 23777369. Pubmed Central PMCID: PMC3709590. Epub 2013/06/20. eng.
69. Ryan BL, Brown JB, Terry A, et al. Implementing and Using a Patient Portal: A qualitative exploration of patient and provider perspectives on engaging patients. *Journal of innovation in health informatics*. 2016 Jul 4;23(2):848. PubMed PMID: 27869582. Epub 2016/11/22. eng.
70. 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). *Journal of health communication*. 2010;15 Suppl 2:183-96. PubMed PMID: 20845203. Pubmed Central PMCID: PMC3014858. Epub 2010/09/29. eng.
71. Sarkar U, Karter AJ, Liu JY, et al. Social disparities in internet patient portal use in diabetes: evidence that the digital divide extends beyond access. *Journal of the American Medical Informatics Association : JAMIA*. 2011 May 1;18(3):318-21. PubMed PMID: 21262921. Pubmed Central PMCID: 3078675.
72. Schneider H, Hill S, Blandford A. Patients Know Best: Qualitative Study on How Families Use Patient-Controlled Personal Health Records. *Journal of medical Internet research*. 2016 Feb 24;18(2):e43. PubMed PMID: 26912201. Pubmed Central PMCID: PMC4785240. Epub 2016/02/26. eng.
73. Sharp LK, Carvalho P, Southward M, et al. Electronic Personal Health Records for Childhood Cancer Survivors: An Exploratory Study. *Journal of adolescent and young adult oncology*. 2014 Sep 1;3(3):117-22. PubMed PMID: 25276495. Pubmed Central PMCID: PMC4171113. Epub 2014/10/03. eng.
74. Sieck CJ, Hefner JL, Schnierle J, et al. The Rules of Engagement: Perspectives on Secure Messaging From Experienced Ambulatory Patient Portal Users. *JMIR medical informatics*. 2017 Jul 4;5(3):e13. PubMed PMID: 28676467. Pubmed Central PMCID: PMC5516097. Epub 2017/07/06. eng.
75. Smith SG, O'Connor R, Aitken W, et al. Disparities in registration and use of an online patient portal among older adults: findings from the LitCog cohort. *Journal of the American Medical Informatics Association : JAMIA*. 2015 Jul;22(4):888-95. PubMed PMID: 25914099. Pubmed Central PMCID: PMC4810779. Epub 2015/04/29. eng.
76. Tenforde M, Nowacki A, Jain A, et al. The association between personal health record use and diabetes quality measures. *Journal of general internal medicine*. 2012 Apr;27(4):420-4. PubMed PMID: 22005937. Pubmed Central PMCID: 3304034.
77. Tieu L, Sarkar U, Schillinger D, et al. Barriers and Facilitators to Online Portal Use Among Patients and Caregivers in a Safety Net Health Care System: A Qualitative Study. *Journal of medical Internet research*. 2015 Dec 3;17(12):e275. PubMed PMID: 26681155. Pubmed Central PMCID: PMC4704882. Epub 2015/12/19. eng.
78. Tieu L, Schillinger D, Sarkar U, et al. Online patient websites for electronic health record access among vulnerable populations: portals to nowhere? *Journal of the American Medical Informatics Association : JAMIA*. 2017 Apr 1;24(e1):e47-e54. PubMed PMID: 27402138. Pubmed Central PMCID: PMC6080722. Epub 2016/07/13. eng.
79. Tom JO, Mangione-Smith R, Solomon C, et al. Integrated personal health record use: association with parent-reported care experiences. *Pediatrics*. 2012 Jul;130(1):e183-90. PubMed PMID: 22689872. Epub 2012/06/13. eng.
80. Urowitz S, Wiljer D, Dupak K, et al. Improving diabetes management with a patient portal: a qualitative study of diabetes self-management portal. *Journal of medical Internet research*. 2012 Nov 30;14(6):e158. PubMed PMID: 23195925. Pubmed Central PMCID: PMC3510725. Epub 2012/12/01. eng.
81. van den Heuvel SCGH, Meije D, Regeer EJ, et al. The user experiences and clinical outcomes of an online personal health record to support self-management of bipolar disorder: A pretest-posttest pilot study. *Journal of Affective Disorders*. 2018 2018/10/01;238:261-8.
82. Wade-Vuturo AE, Mayberry LS, Osborn CY. Secure messaging and diabetes management: experiences and perspectives of patient portal users. *Journal of the American Medical Informatics Association : JAMIA*. 2013 May 1;20(3):519-25. PubMed PMID: 23242764. Pubmed Central PMCID: PMC3628058.

Epub 2012/12/18. eng.

83. Wagner PJ, Dias J, Howard S, et al. Personal health records and hypertension control: a randomized trial. *Journal of the American Medical Informatics Association* : JAMIA. 2012 Jul-Aug;19(4):626-34. PubMed PMID: 22234404. Pubmed Central PMCID: 3384099.
84. Wagner PJ, Howard SM, Bentley DR, et al. Incorporating patient perspectives into the personal health record: implications for care and caring. *Perspectives in health information management*. 2010 Oct 1;7:1e. PubMed PMID: 21063546. Pubmed Central PMCID: 2966356.
85. Weppner WG, Ralston JD, Koepsell TD, et al. Use of a shared medical record with secure messaging by older patients with diabetes. *Diabetes care*. 2010 Nov;33(11):2314-9. PubMed PMID: 20739686. Pubmed Central PMCID: PMC2963486. Epub 2010/08/27. eng.
86. Williamson RS, Cherven BO, Gilleland Marchak J, et al. Meaningful Use of an Electronic Personal Health Record (ePHR) among Pediatric Cancer Survivors. *Applied clinical informatics*. 2017 Mar 15;8(1):250-64. PubMed PMID: 28293684. Pubmed Central PMCID: PMC5373768. Epub 2017/03/16. eng.
87. Zickmund SL, Hess R, Bryce CL, et al. Interest in the use of computerized patient portals: role of the provider-patient relationship. *Journal of general internal medicine*. 2008 Jan;23 Suppl 1:20-6. PubMed PMID: 18095039. Pubmed Central PMCID: PMC2338160. Epub 2008/01/10. eng.
88. Gordon P, Camhi E, Hesse R, et al. Processes and outcomes of developing a continuity of care document for use as a personal health record by people living with HIV/AIDS in New York City. *International journal of medical informatics*. 2012 Oct;81(10):e63-73. PubMed PMID: 22841825. Pubmed Central PMCID: 4447096.
89. Luque AE, van Keken A, Winters P, et al. Barriers and Facilitators of Online Patient Portals to Personal Health Records Among Persons Living With HIV: Formative Research. *JMIR research protocols*. 2013 Jan 22;2(1):e8. PubMed PMID: 23612564. Pubmed Central PMCID: 3628162.
90. Martinez M, Baum A, Gomez Saldano AM, et al. Predictive variables of the use of personal health record: the Hospital Italiano de Buenos Aires study. *Studies in health technology and informatics*. 2013;192:1171. PubMed PMID: 23920945. Epub 2013/08/08. eng.
91. Rocha RA, Romeo AN, Norlin C. Core features of a parent-controlled pediatric medical home record. *Studies in health technology and informatics*. 2007;129(Pt 2):997-1001. PubMed PMID: 17911865. Epub 2007/10/04. eng.
92. van den Heuvel S, Meije D, Regeer EJ, et al. The user experiences and clinical outcomes of an online personal health record to support self-management of bipolar disorder: A pretest-posttest pilot study. *Journal of affective disorders*. 2018 Oct 1;238:261-8. PubMed PMID: 29894931.
93. Kushniruk AW, Turner P. Who's users? Participation and empowerment in socio-technical approaches to health IT developments. *Studies in health technology and informatics*. 2011;164:280-5. PubMed PMID: 21335724.
94. Niazkhani Z, Pirnejad H, de Bont A, et al. CPOE in Non-Surgical Versus Surgical Specialties: A Qualitative Comparison of Clinical Contexts in the Medication Process. *The open medical informatics journal*. 2010 Sep 15;4:206-13. PubMed PMID: 21594008. Pubmed Central PMCID: 3096890.
95. Pirnejad H, Niazkhani Z, Aarts J, et al. What makes an information system more preferable for clinicians? a qualitative comparison of two systems. *Studies in health technology and informatics*. 2011;169:392-6. PubMed PMID: 21893779.
96. Niazkhani Z, van der Sijs H, Pirnejad H, et al. Same system, different outcomes: comparing the transitions from two paper-based systems to the same computerized physician order entry system. *International journal of medical informatics*. 2009 Mar;78(3):170-81. PubMed PMID: 18760660.
97. O'Connor S, Hanlon P, O'Donnell CA, et al. Understanding factors affecting patient and public engagement and recruitment to digital health interventions: a systematic review of qualitative studies. *BMC medical informatics and decision making*. 2016 Sep 15;16(1):120. PubMed PMID: 27630020. Pubmed Central PMCID: 5024516.
98. Caldwell HD, Minkoff NB, Murthy K. Patient web portals and patient-provider relationships: a summary perspective. *International journal of technology assessment in health care*. 2017 Jan;33(1):63-8. PubMed PMID: 28434422. Epub 2017/04/25. eng.
99. Epping-Jordan JE, Pruitt SD, Bengoa R, et al. Improving the quality of health care for chronic conditions. *Quality & safety in health care*. 2004 Aug;13(4):299-305. PubMed PMID: 15289634. Pubmed Central PMCID: 1743863.
100. Yau GL, Williams AS, Brown JB. Family physicians' perspectives on personal health records: qualitative study. *Canadian family physician Medecin de famille canadien*. 2011 May;57(5):e178-84. PubMed PMID: 21642732. Pubmed Central PMCID: 3093606.
101. Wynia MK, Torres GW, Lemieux J. Many physicians are willing to use patients' electronic personal health records, but doctors differ by location, gender, and practice. *Health affairs*. 2011 Feb;30(2):266-73. PubMed PMID: 21289348.
102. Witry MJ, Doucette WR, Daly JM, et al. Family physician perceptions of personal health records. *Perspectives in health information management*. 2010 Jan 1;7:1d. PubMed PMID: 20697465. Pubmed Central PMCID: 2805556.
103. Mishuris RG, Stewart M, Fix GM, et al. Barriers to patient portal access among veterans receiving home-based primary care: a qualitative study. *Health expectations : an international journal of public participation in health care and health policy*. 2015 Dec;18(6):2296-305. PubMed PMID: 24816246. Pubmed Central PMCID: 5810689.
104. Horan TA, Botts NE, Burkhard RJ. A multidimensional view of personal health systems for underserved populations. *Journal of medical Internet research*. 2010 Aug 4;12(3):e32. PubMed PMID: 20685644. Pubmed Central PMCID: 2956321.
105. Kaelber DC, Jha AK, Johnston D, et al. A research agenda for personal health records (PHRs). *Journal of the American Medical Informatics Association* : JAMIA. 2008 Nov-Dec;15(6):729-36. PubMed PMID: 18756002. Pubmed Central PMCID: 2585530.
106. Jung SY, Lee K, Hwang H, et al. Support for Sustainable Use of Personal Health Records: Understanding the Needs of Users as a First Step Towards Patient-Driven Mobile Health. *JMIR mHealth and uHealth*. 2017 Feb 23;5(2):e19. PubMed PMID: 28232300. Pubmed Central PMCID: 5344982.
107. Kooij L, Groen WG, van Harten WH. Barriers and Facilitators Affecting Patient Portal Implementation from an Organizational Perspective: Qualitative Study. *Journal of medical Internet research*. 2018 May 11;20(5):e183. PubMed PMID: 29752253. Pubmed Central PMCID: 5970285.

Tables

Table 1. Studies providing information on barriers to PHR adoption and use in chronic care

Authors (year of publication) [1]	Study objective	Research method	Country	Features of PHRs (if any)	Integration with EMR/EHR	PHR's target chronic patient population	Study participants	Main our relation objective current :
Lober et al. (2006) (1)	To evaluate the barriers faced by a low income, elderly population in creating and using a personal health record.	Qualitative	The USA	A Personal Health Information Management System (PHIMS), allows viewing personal demographics, past surgeries and immunization records, environmental factors and foods, medications and allergies to medications, also with capabilities of messaging with provider, sharing printed version of information with providers or family	Untethered	Adults elderly patients	38 elderly residents of a nursing home, many had chronic disease	- Health a literacy a - Physical cognitive of elderly - Problem access to computer owning a and acces assistant system (e availability or social
Hess et al. (2007) (2)	To explore challenges to office-based implementation of a patient portal and initial patient reaction to the technology in the context of diabetes care	Qualitative	The USA	University of Pittsburgh Medical Center (UPMC) HealthTrak (a patient portal) allowing to view test results, medication and problem lists, and health reminders, secure, electronic communication with the physician's office, to view and schedule appointments, and disease-specific tools and information plus self-management tools for weight and blood pressure monitoring	Tethered	Adults diabetic patients	Diabetic patients	- Patient i inefficient missing k radiology inaccurate informati response: physician nurse. - Barriers including unknown and passv unaware features of HealthTra possible t of patient not just th care phys lack of co and integ
Zickmund et al. (2008) (3)	To discern the impact of the provider-patient relationship on interest in using a web-based patient portal	Qualitative	The USA	"HealthTrak", a patient portal originally offered online information, laboratory results, and an encrypted and secure method for e-mailing messages. The enhanced version for diabetes patients allowed them to track glucose, blood pressure, and physical activity records online entered by them	Tethered	Adults diabetes patients	Patients with diabetes	- Disinter use was l patient se with the p provider i so as part a satisfyin patient re appeared of the pat - Barriers the system lower con literacy a required t - Fear of l personal communic their prior physician emails (o portal fun - Concern the office reading th messages the portal the indire the e-mai through p
Britto et al. (2009) (4)	To evaluated the usability of "MyCare Connection" portal for parents of children with cystic fibrosis, diabetes or arthritis.	Mixed	The USA	Web-based secured web application allowing to view demographic and contact information; laboratory, radiology and pathology reports; inpatient and outpatient encounters;	Tethered	Children with cystic fibrosis, diabetes or arthritis	Parents of children with cystic fibrosis, diabetes or arthritis	- Clarity c and the a comprehe messages least in th satisfacti - A numbe problem issues inc

				medications; and secure electronic messaging				of medical terminology; problem-solving; normal values; in overload; information requiring interpretation; explanation; help; optical; bold; and catching; instructions needed
Kim et al. (2009) (5)	To assess the use and utility of PHRs in a low-income, elderly population	Quantitative	The USA	A stand alone, individually controlled, Web-based repository of personal health information allowing users to enter, update, or delete structured information in nine different categories. It provides summary pages that list all the information entered into the system by the user. A hardcopy and/or electronic copy can be shared with health care providers or family members.	Untethered	Adults elderly chronic patients	Elderly residents of a nursing home with chronic diseases	- Most (77%) of the system users were assistant graduate students; staff was the resident
Sarkar et al. (2010) (6)	To examine use of an internet-based patient portal among a well characterized cohort of English-speaking adult patients with diabetes differed between those who report limited health literacy versus those who do not.	Quantitative	The USA	An internet based patient portal allows viewing laboratory test results, sending email to providers, requesting medication refills, and making medical appointments.	Tethered	Adults diabetes patients	Diabetes patients	- African-American, Latino, and race/ethnicity lower education attainment associated with increased signing on patient portal - Those with health literacy higher odds signing on patient portal
Weppner et al. (2010) (7)	To Evaluate use of a web-based shared medical record (SMR) between older patients with diabetes and providers.	Quantitative	The USA	A web-based shared medical record allowing a secure messaging with health care providers, request medication refills and in-person appointments; and view test results, after-visit summaries, medical problem lists, allergies, and immunizations.	Tethered	Adults diabetes patients	Diabetes patients	- Unadjusted age, male sex, higher socioeconomic neighborhood, primary care level of service, messaging associated with patients' use - Higher rates of patients with higher sign continued system
Wagner et al. (2010) (8)	To examine patient perspectives on ePHR use and functionality as part of the development process of an existing ePHR	Qualitative	The USA	My HealthLink, an ePHR enabled consumers to store personal health information with core functions of secure messaging; access to educational materials; medication interaction checking; recording and monitoring health measures, for example, blood pressure; and goal setting and health diaries.	Untethered	Adult patients with hypertension	16 patients with hypertension	- User the requiring some difficult understanding terminology relationships providers overwhelmed time constraints of using F ePHR - Technology mainly related to health literacy, usability, access, and additional and the personalized systems - Linkage systems

								- Desire to have access to those portals
Nordfeldt et al. (2010) (9)	To explore patients' and parents' attitudes toward a local Web 2.0 portal tailored to young patients with type 1 diabetes and their parents and opportunities and obstacles to the application of the system	Qualitative	Sweden	A Patient portal called "Diabit" containing specific diabetes-related information and social networking functions such as message boards and blogs and allowing medical prescription renewal, making appointments, sending questions, viewing questions and answers, contact information, photos of staff, and other general information about the local diabetes teams and their services. Used by patients, parents and providers.	Not documented	Children with diabetes	16 mothers and 3 fathers of sick children, and 5 young patients (11-18 years old)	<p>- The experience already by control and secure with treatment/period of reason for of the portal</p> <p>- Previous contact with practitioner continuity regarding relationship sufficient experience with diabetes perceived success with treatment/mentioned that might lead to a lower need for use of the portal</p> <p>- Various user experience as few hit specific issues seeing that there had been little the practice and update of the portal create the that the portals were not "toes"</p> <p>- Issues with password</p> <p>- Users with particular feelings about disease and care experience might not go through procedure onto a digital portal.</p>
Goel et al. (2011) (10)	To identify patient reported barriers to enrollment in a patient portal among patients who did not enroll despite being directly offered this service by their providers	Quantitative	The USA	MyChart, a patient portal allowing a patient to log-on to a secure portal to access personalized health information, including laboratory results and a medication list and sending secure electronic messages to physicians.	Tethered	Adult chronic patients	Chronic patients including diabetes, hypertension, chronic pulmonary disease, coronary artery disease, congestive heart failure, peripheral vascular disease, severe chronic liver disease, renal failure, cancer, and dementia	<p>- Reasons for enrolling: remembered the patient their provider did not attempt to enroll me remembered discussion with providers attempted to enroll did not succeed</p> <p>- Reasons for attempting enrollment: stated reason to lack of information or motivation reported attitudes patient perceived reported obstacles</p> <p>- There was no significant difference for not attempting enrollment black people mentioned negative impact on connectivity</p>

								<p>- There was a difference for not at enrollment presence of disease (information was cited chronic disease 71% with disease)</p> <p>- Addition for not at enrollment they preferred providers discuss health rather than communicate electronic nearly 25% they did not internet is to communicate sensitive information</p>
Tenforde et al. (2011) (11)	To measure the association between use of an advanced electronic medical record-linked PHR and diabetes quality measures in adults with diabetes mellitus (DM).	Quantitative	The USA	MyChart, the Cleveland Clinic's electronic medical record (EMR)-linked PHR, allowing to access patient's diagnoses and co-morbidities, laboratory and other test results, along with secure messaging through the PHR with their provider. Patients can also access glucometer readings, a set of diabetes-related health and wellness links, and diabetes specific health reminders (including recommended glycated hemoglobin, urine albumin, and cholesterol testing due dates, recommendation for pneumococcal vaccination, and due dates for diabetic foot and dilated retinal eye exams).	Tethered	Adult diabetes patients	4,036 diabetes patients	<p>- Compared users, PH younger, lower incomes & education attainment likely to be as Caucasians better unadjusted quality measure profiles</p>
Sarkar et al. (2011) (12)	To examine patient use patterns of an innovative internet-based patient portal within a well-characterized large, diverse cohort of adult medically insured patients with diabetes	Quantitative	The USA	An internet-based patient portal allowing to view laboratory test results, email physicians or care team, request medication refills, and make appointments.	Tethered	Adult diabetes patients	5671 diabetes patients	<p>- African-American (31%), Latino and Filipino participants likely, and White participants likely to be password internet-based portal (a internet attempt to rely on to the requesting password</p> <p>- Compared Hispanic & African-American Latinos had odds of non-use, as did without a degree or college graduate</p> <p>- Age over 65 was associated with lack of use entire cohort</p> <p>- Compared who used portal, no more likely suboptimal</p>

								their diab related ri
Nielsen et al. (2012) (13)	To evaluate the use of a secure internet portal in an academic Multiple Sclerosis (MS) Center	Quantitative	The USA	"PatientSite", a patient internet portal allowing individuals to manage their clinic appointments (making, canceling, or rescheduling with department administrators), request prescription refills and referrals directly to their physician's office, view their medical records including labs, pathology, and radiology study results, and communicate directly with their provider regarding non-urgent issues through a secure electronic message system. In addition, PatientSite provided web links to helpful health-related information, an account statement for patient medical bills, and technological support to portal users	Tethered	Adult multiple sclerosis patients	240 multiple sclerosis patients	<ul style="list-style-type: none"> - Portal u to be you with mini disability. predictor: barriers c include th medicatio prescribe p<0.0001 ethnicity (p<0.007), hand disa 0.23, p<0 impaired 0.31, p<0 - Barriers included l minority (odds), wc acuity (0. and upper function (odds). - The nur visits sch greater a users con non-users A trend to greater p 'no-shows was found portal no ±10.7 vs. p=0.12).
Wagner et al. (2012) (14)	To examine the impact of a PHR in patients with hypertension measured by changes in biological outcomes, patient empowerment, patient perception of quality of care, and use of medical services.	Quantitative	The USA	My HealthLink, which provided a secure, comprehensive, electronic record that enables consumers to store PHI. This PHR is "allowing to view problem lists and information on medications, allergies, and immunizations Core functions also include: secure messaging; access to educational materials; medication interaction checking; recording and monitoring of health measures, for example, BP; and some goal setting and health diaries.	Tethered	Adult patients with hypertension	443 hypertensive patients	<ul style="list-style-type: none"> - Younger reported skills, and positive p communic were asso frequency vs. no use - In multiv analysis, Family M (versus th Internal M those with number o reported items, and provider communic had signif frequent l
Day and Gu (2012) (15)	To find out: what factors influence PHR use? Do perception of ease of use influence patient's engagement with the software? What is about available software that is considered useful by patients?	Qualitative	New Zealand	PHR linked to their doctor's Practice Management System (PMS) allows viewing laboratory results, diagnosis, immunizations and medications list Capabilities: interaction patients with their GP, signing patients to system via internet at home and accept electronic invitations	Tethered	Adults chronic patients	Chronic patients (not specified)	<ul style="list-style-type: none"> - Require and healt which cor being abl effective PHR - Usability navigatio was not in some PH were not - Concern PHR-relat are paid f and unde circumsta necessity motivatio getting a of free co and payin
Emani et al. (2012) (16)	To apply a theoretical model, the diffusion of innovation model, to the study of PHRs and conduct an exploratory empirical study on the	Quantitative	The USA	Patient Gateway, allowing requests for appointments, prescription refills and referrals, access to certain components of	Tethered	Adult asthma, CHF, hypertension, or diabetes patients	Asthma, CHF, hypertension, or diabetes	<ul style="list-style-type: none"> - Comput non-adop was lowe among PH (99%) and (92%) (P

	applicability of the model to the study of perceptions of PHRs			the EHR such as laboratory results, and secure messaging with the practice and provider				<p>Non-adop reported on persor innovative informati technolog</p> <p>- Innovatc younger t users and adopters</p> <p>- Only 50% adopters year colle more corr 76% of th 71% of la 69% of ot = 0.001).</p> <p>- Only 41% adopters household \$75,000 c comparec laggards, innovator other use 0.001).</p> <p>- Non-ado differed f innovator laggards status (47 < 0.001).</p> <p>- In terms health stz adopters lower rati health co: innovator laggards, users and reported health stz innovator also repo smaller n comorbid 2.8) than rejecters, adopters 3.7).</p> <p>-The grea relative a ease of u trialabilit; the more value the communic their doct</p> <p>- More po perceptio and secur informati are assoc greater p value of t</p>
Tom et al. (2012) (17)	To examine integrated personal health record use patterns among parents of children with chronic disease and compare ratings of care experiences between integrated PHR users and nonusers.	Quantitative	The USA	<p>In “MyGroupHealth” parents access their child’s account as a proxy through their own account.</p> <p>Users can viewing: immunizations, test results, after-visit summaries, allergies, medical conditions, health assessments, health plan benefits and medication management</p> <p>Capabilities: secured messaging and appointment management.</p>	Tethered	Children with chronic disease	Parents of a child with at least one chronic disease (types not specified)	<p>- The top not using among nc “too busy login nam password does not l care need</p> <p>- Some pe noted tha not comfc sharing rr informati Internet</p> <p>- Other re using the login nam password to get onl for the PI having ac high-spee too diffic response</p>

								not sure if the Interv - Preferred routes of face to face of the PH
Urowitz et al. (2012) (18)	To evaluate the experience of patients and providers using an online diabetes management portal for patients.	Qualitative	Canada	A Patient portal which provides access to "Health Library" for diabetes education material (for both patient and providers) and providers access to "Personal Health Records" for allowing patients to consolidate their personal health information including medical and family history, medication details, lifestyle choices, and test results	Tethered	Adults patients with diabetes	Patients with diabetes and their providers i.e., general practitioners (GPs), nurses, nurse practitioners (NPs), dieticians, diabetes educators (DECs), and other clinical staff	- Technical regarding discovera access to difficult d and diffic items) - Some pa that they controllin diabetes , that their measurer been fairl therefore the need informati - Required duplicate efforts to issues rel PHR use those in t time, ther a tool for other car - Provider overreliar patients c when exa their conc
Gordon et al. (2012) (19)	To describe the process and outcome of developing and implementing a personal health record for people living with HIV/AIDS	Mixed	The USA	My health profile allowing to access most recent medication lists, test results, information on healthcare providers and payers, viewing an integrated audit log, and enabling the development a continuity of care document	Tethered	Adult	Patients living with HIV	- Potentia use of My Profile in functional computer privacy an confident concerns, reluctanc technolog cognitive (e.g., rem password - PHR imq was well the organ mission a and priori to coordin
Logue et al. (2012) (20)	To describe the results of an exploratory study that provided an initial test of a theoretical framework to understand an elderly's decision to participate in self-directed care	Quantitative	The USA	Without a PHR	Not applicable	Adult chronic condition	Senior adults with chronic conditions	- Older se reported . confident ability to - based PH not perce had the re place to u - More me women aq they had i care, acco internet, a computer to be a be their heal needs, an confident internet t communic others an internet-b -ethnicity - Older se less likely how to fir resources internet a

									<p>interested the use of</p> <p>- Those who were more about health records were available internet version likely to be motivated incentives PHRs.</p> <p>- Older seniors less confidence in their own contrast, did not rely computer however, have less and family the internet</p> <p>- Easier access was positively correlated believing offer an alternative methods, were common their current health needs and were likely give them that they Those they reported to care almost like express concern their ability communicate via written and self-report health</p> <p>- Of the respondents who disagreed the three indicators 18) reported having access computer = 17) reported having access internet. ' indicate that access is prerequisite knowing what and how to resources internet</p> <p>- More females than males reported how to use internet PHRs;</p> <p>- The internet PHRs within year was positively with the likelihood accepting incentives In addition motivation was positively correlated individual in using a based PH likelihood would choose provider version</p>
--	--	--	--	--	--	--	--	--	--

								<ul style="list-style-type: none"> - Many mo (28%) w about priv comparec (10%) - Those w to work to their healthcar a team w likely to b motivated things, kn health resources available internet, l using an i based PH them the health ou sought, b to use PHRs, pr control w access th a fit betw current h needs and intereste one - Positive were also between t of illness reported fitting the healthcar Responde more illne more like a healthc based on provider's informati PHR. Tho multiple l providers same peo preferred their own intended within the believed t were com their curr healthcar would cho provider's informati PHRs
Britto et al. (2013) (21)	To examine parents' perceptions of the benefits and / or drawbacks of a patient portal for managing their child's chronic illness.	Qualitative	The USA	A secure Internet-based application which integrated to an EHR Users can viewing: laboratory results, visit history, medication information Capabilities: secure messaging to health care providers, upload documents and share with health care providers and reminders for laboratory tests and clinic visits.	Tethered	Children with Cystic fibrosis, Diabetes mellitus or Juvenile idiopathic arthritis	Parents of children with cystic fibrosis, diabetes mellitus or juvenile idiopathic arthritis	<ul style="list-style-type: none"> - A potent on the los interspers with prov some par preferenc communic particular hearing b news - A concei knowing v receive el communic whether a answer
Osborn et al. (2013) (22)	To (1) understand who uses an existing patient portal and reasons for use and nonuse, (2) understand how portal users are using a portal to manage their medications, and (3) explore participants' ideas for improving portal functionality for	Mixed	The USA	MyHealthAtVanderbilt, a patient portal allowed managing medical bills, viewing PHI (eg, vital signs, laboratory results, medication lists, and diagnoses) from their electronic health record (EHR), using secure messaging to communicate with	Tethered	Adults diabetes patients type 2	75 adults with type 2 diabetes	<ul style="list-style-type: none"> - Users w likely tha be Cauca have high and be pr insured. l tended to education nonusers

	medication management and adherence support.			providers and manage medical appointments, and view educational contents				- Reasons included 1 about the having ac computer family me as an onli
Ronda et al. (2013) (23)	To study the characteristics, the health status, the self-efficacy, the diabetes knowledge, and the treatment satisfaction of patients with diabetes who do and do not have a login for a patient Web portal	Quantitative	The Netherlands	A patient portal allowing users to access their medical records, including the information provided by their healthcare provider during medical consultation, such as physical examination, laboratory results, problem lists, and treatment goals. It also provides access to general diabetes information and an overview of all examinations and diabetes visits that are needed according to guidelines. Patients can upload the glucose levels measured at home and seek contact with their care provider through secured electronic messaging	Tethered	Adults diabetic patients types 1 and 2	Diabetic patients of 18–85 years old	<p>- The part a login we significant comparec without. (participar login, 63. male com 56.5% of without lc</p> <p>- In Type patients v were you a higher € level. Foll guideline: diabetes j treated b however, without a more frec to be trea general p</p> <p>Type 2 di patients v had been with diab longer tin insulin m frequently used mor comparec without a</p> <p>- Patients login sign perceived diabetes-i distress t with login less self-€ lower dia knowledg</p> <p>- With inc the odds € a login de Also, the € requestin increased patients v education patients v Dutch flu€ patients v job, wher decrease€ treated b care phys internist) alone.</p>
Wade-Vuturo et al. (2013) (24)	To identify the benefits of and barriers to using secure messaging (SM) within a portal.	Mixed	The USA	A patient portal which called “MyHealthAtVanderbilt (MHAV)”. Users can view EHR data, use secure messaging to communicate with providers, manage medical appointments and bills, and perform other tasks.	Tethered	Adult diabetes patients type 2	Patients with type 2 diabetes	<p>- Barriers (a) preco beliefs at technolog about SM questiona of the pat facilitate productiv exchange providers negative € with SM (receiving to a patie message)</p> <p>- Percepti provider € of SM i.e. participar assumptio</p>

								providers to use SM being inte SM, and i being rein SM, (b) p instructio (e.g., part recounted when pro instructed use SM)
Lyles et al. (2013) (25)	To examine the associations between patient ratings of provider communication or trust with portal use in diabetes patients.	Quantitative	The USA	Patient portal allowing users to view visit summaries, medical history, and/or immunizations/allergies, making appointments, order medication refills, view the results of medical tests, and send or receive secure electronic messages with providers.	Tethered	Adults diabetes patients	Diabetes patients	<ul style="list-style-type: none"> - There w significant adjusted i between i trust and registere - Among p years of a was a sig associatio patient-pr communic portal use -There we significant between i provider a race/ethn Latino su more like registere there was in the pro were whi and patie age - After ad there was associatio trust in pr overall se message
Pai et al. (2013) (26)	To determine the experience of, and feedback from, prostate cancer patients using a PHR, while receiving care from a provincial cancer agency.	Mixed	Canada	"Provider": a web-based integrated with an electronic clinical information system to store and access the medical records of patients with cancer. With access to laboratory, pathology, imaging, operative, and procedure reports, scheduling and appointment information and medications, secure messaging patient-provider and etc.	Tethered	Adult patients with prostate cancer	Male patients with prostate cancer	<ul style="list-style-type: none"> - Mixed re lack of ck should pa PHR, for a federal go provincial cancer ag health ca donations private in clients (th patients), Besides c other opti felt that t governme help fund - Several difficultie "Provider were rep patients c research
Martinez et al. (2013) (27)	To identify the characteristics of PHR users versus non-users	Quantitative	Argentina	A web-based PHR allowing patients to view laboratory results, diagnosis, preventive information and medications lists and also to communicate with doctors or health care systems (e.g., for massaging system, appointments scheduling or medication delivery, and to get support for self-management)	Tethered	Adult chronic patients	Chronic patients with hypertension, diabetes, dyslipidemia, cerebral vascular disease, coronary artery disease, chronic heart failure, chronic renal failure, peripheral vascular disease, and smokers	<ul style="list-style-type: none"> - PHR us younger a and had a disability condition asked for assistanc last year - The mai PHR use patient as medical a during the increasing use by all
Luque et al. (2013) (28)	To assess barriers and facilitators to use of online PHRs among	Mixed	The USA	Using an exemplary PHR	Tethered	Adult	Patients living with human immunodeficiency virus	<ul style="list-style-type: none"> - Lack of broadband also priva accessing

	persons living with human immunodeficiency virus							outside of were mer important computer barrier bu insurmou - Barriers the Interr responde (16/90,18 interest (and do no to use (5/
Byczkowski et al. (2014) (29)	To assess parents understanding of the importance of PHR, their concerns for using web-based portals for their children's diseases	Mixed	The USA	A web based patient portal allowing access laboratory result, medication information, and a child's visit history	Tethered	Children with cystic fibrosis, diabetes mellitus, and juvenile idiopathic arthritis	530 parents of children with cystic fibrosis, diabetes mellitus, and juvenile idiopathic arthritis	- 12 perce that they saw infor portal tha them, and reported - sometime informati would hav to get dir their prov - Request for easier the syste navigatio more per informati to the chi condition, medical t explanatio notificatio lab result
Fiks et al. (2014) (30)	To design a portal to facilitate shared decision making between families of children with asthma and primary care clinicians based on user-identified criteria and integrated within the EMR	Qualitative	The USA	A Patient portal which called "MyAsthma" and it's was designed to work within the framework of an existing patient portal, MyChart, and was linked to The children's Hospital of Philadelphia's EMR through a Web-based framework	Tethered	Children with asthma	7 parents of children with asthma and 51 care providers including pediatricians, nurses, and a pharmacist	- Preferer communic physician - System i should be the conte - Provider should be access to chronic co not for an in the con
Sharp et al. (2014) (31)	To characterize the knowledge, interest, and attitudes of childhood cancer survivors and their caregivers towards ePHRs.	Qualitative	The USA	Without a specific PHR	Not applicable	Children with cancers	Caregivers of survivors who were <14 years old and also survivors ≥14 years old along with their caregivers when present	- Data sec privacy w primary c expresse who had i However, them, 67% and 80% i stated the concern v prevent tl using an e
Odum et al. (2014) (32)	To assess the ease of use and usefulness of My Health Profile (MHP) and to identify the actual information needs of MHP-users and perceived information needs of MHP-users and MHP non-users before MHP-plus roll out.	Mixed	The USA	MyHealthProfile, a continuity of care document enabling access to facets of medical records through the internet	Untethered	Adults people living with HIV	People living with HIV	- Problem including health inf the MHP vaccinatio diagnosti results); i informati MHP. - Participa expresse health inf better fac provider v - Frustrat how to gr access, a they know the syste
Barron et al. (2014) (33)	To explore whether older adults with chronic conditions and/or their caregivers demonstrate capacity to use a patient portal, and their perspectives on the experience	Qualitative	The USA	A patient portal enables accessing the P/A/M/I lists, office notes, hospital discharge summaries, and test results	Tethered	Adult chronic obstructive pulmonary disease or congestive heart failure	14 patients and 19 caregivers	- Usability related to medical t and color issues, ar section la

Baudendistel et al. (2015) (34)	To explore needs and requirements of potential users with regard to the content and function of a patient-controlled personal electronic health record	Qualitative	Germany	Without a PHR	Not applicable	Adult patients with colorectal cancer	Patients with colorectal cancer, health care providers, clinicians, clinical staff in an umbrella company	- Needs a requirements structure facilitate course of treatment for both p and patie important informati or a prior current is a basic d relevant i that woul for every in the pat care with volume of - The pre: informati in a patie: assessabl accessibl comprehe - Given th several pl from diffe care setti have PHF physician concerns uncertain negative consequ professio for reacti added inf comment
Gartrell et al. (2015) (35)	To examine factors associated with ePHR use by nurses for their own health management	Quantitative	The USA	Different PHRs	Not applicable	Adults chronic patients	664 sick nurses with chronic conditions in 12 hospitals	- A larger ePHR use chronic m condition taking a p medicatio comparec (65%) (P - A large p PHR user Internet f (several t comparec non-users -A larger ePHR use more awa technolog nearly 80 comparec approxim nonusers their prior providers used an E (p<0.01) - More eP (72%) w concern general p security c informati comparec (64%, p= - Factors with ePH an active consumer chronic h condition prescribe medicatio having a l provider i for care,
Gee et al. (2015) (36)	To learn from chronically ill engaged and educated	Qualitative	The USA	Different PHRs (Core functions were not	All tethered	Adults chronic patients	18 chronic patients	- Health a literacy is

	(e-patient) adults how and why they use PHRs for self-management support and productive patient-provider interactions.			documented)				<p>understand numbers : their individual condition: navigating PHR)</p> <ul style="list-style-type: none"> - Usability the use of jargons) - Frustration seeing incorrect medication medical history the PHR is able to in through the - Lack of adequate on the use - Concern privacy of banking data informati - Provider issues (e. for involving providers pharmacists therapists lack of clarity who may content of messages physician staff); providing the concerns provider following - A lack of interoperability between provider and other systems resulting related to coordination offices the EHR/PHR those still based systems
Harrison et al. (2015) (37)	To understand perceptions of CKD patients about ePHRs, and describe characteristics associated with their expressed intent to use an ePHR.	Quantitative	Canada	Without a PHR	Not applicable	Adults patients with non-dialysis-dependent CKD	Patients with non-dialysis-dependent CKD	<ul style="list-style-type: none"> - Patients of 65 were to intend ePHR - No association between self-perceived and intend ePHR - Those with secondary and Inter were more express to use an ePHR - 69.8 % of group into an ePHR available - Patients convey in the ePHR report an benefit of often -The perceived benefits of personal in health to health and lab results associate

								expressed use - Privacy concerns - records are not common - noted registration
Nippak et al. (2015) (38)	To explore the perceptions of family members regarding the importance of an electronic personal health record to support the care of their loved ones within a long term care facility	Mixed	Canada	MyChart: a secure and private web-based platform that offers self-management tools that are entirely accessed and controlled by patients such as diaries to record their health history, symptoms, and medications, emergency contact information as well it provides access to health education sites and appointment scheduling features	Not documented	Adults elderly chronic patients	Family members of residents residing in a long term care facility	Family members identified linked to: - Privacy, confidentiality, security of electronic record info - The knowledge of understanding information fearing all values - Issues related to use of MyChart staff operating their computer exchange members workload on communication between patients
Tieu et al. (2015) (39)	To explore the barriers and facilitators to use of a patient portal in anticipation of portal implementation in an urban, safety net primary care clinic	Qualitative	The USA	Patient portals in general/without a specific PHR	Not applicable	Adult chronic patients	11 patients with chronic illness including diabetes and 5 caregivers	- Health literacy challenges (e.g., poor reading ability, personal health history with online breaches, distrust of security, lack of basic skills and handling) challenge medical treatment and lack of appropriate information - Concern about affordability of Internet, the cost of - Concern about privacy, confidentiality and security of patients' information, particularly diagnosis, medication, online or accessible research industry - Concern about technology replacing healthcare and diminishing ongoing communication with their
Wells et al. (2015) (40)	To investigate organizational strategies to promote PHR adoption with a focus on patients with chronic disease.	Mixed	The USA	Different PHRs across the country	Not applicable	Adult chronic patients in general	Chief information officers, directors of e-health services, medical directors, or internists with specialized roles in chronic disease management, quality, primary care, or population health	- The greatest barrier to PHR implementation: perceived physician due to their workload and patients. - Discuss how to be

								reimburse interactio
Latulipe et al. (2015) (41)	To investigating facilitators and barriers to adoption of patient portals among low- income, older adults in rural and urban populations older adults in rural and urban populations	Qualitative	The USA	A patient portal in general/Without a specific patient portal	Not applicable	Adults chronic patients	36 chronic patients and 16 caregivers (chosen from low-income, older adult populations across the country)	<ul style="list-style-type: none"> - Lack of : technolog and porta of 36 pati participa which app linked to : - Lacking with resp technolog especially participa remembe password - The mos concern n that of pr security (: to for exa of inform: insurance to deny c - A fear th patient po eventually face-to-fa their heal provider : seen as a negative : of signing - Stress fr reading n informati hearing tl - Unclear get techn assistanc of a probl
Smith et al. (2015) (42)	To document disparities in registration and use of an online patient portal among older adults.	Quantitative	The USA	A patient portal allowing three main options (message a provider, request a prescription reauthorization, and view test results) with additional options including personal health records (monitoring vital statistics [e.g. height, weight, body mass index, body surface area, blood pressure, heart rate, breathing rate, temperature], previous conditions, and current conditions), previous or upcoming appointments, sent and received messages, personal profile, and a help page.	Tethered	Adults with chronic conditions including arthritis, asthma, bronchitis or emphysema, cancer, coronary heart disease, depression, diabetes, heart failure, and hypertension.	534 older adults with chronic conditions including arthritis, asthma, bronchitis or emphysema, cancer, coronary heart disease, depression, diabetes, heart failure, and hypertension.	<ul style="list-style-type: none"> - White pe gender, c graduate: with mar adequate literacy w likely to h register: patient po its option
Eschler et al. (2016) (43)	How do individuals characterize their experiences of and expectations for using asynchronous communication strategies to coordinate health care with clinicians?	Qualitative	The USA	A patient portal allowing to view medical test results, visit summaries, immunization lists, allergy lists, medical condition lists, exchanging secure messaging with providers, ordering medication refills, scheduling an in-person appointment	Tethered	Children with asthma and adults with diabetes	7 parents of children with asthma and 12 adult diabetes patients	<ul style="list-style-type: none"> - Failing t issues fol secure co with care such as a status ind unresolve exposing inconsist communic patterns : either a c written no confuses leading to lapses in managem
Schneider et al. (2016) (44)	To understand patients' lived experience with a patient-controlled electronic health record (PCEHR) and how the	Qualitative	The UK	A patient-controlled electronic health record, called Patients Know Best It allowed patients and clinicians alike to	Untethered	Children with chronic gastrointestinal diseases	16 parents of sick children and a teenager who was ill as well as 11 clinicians	<ul style="list-style-type: none"> - Patients to take po responsib: health thr technolog

	use of such a technology may lead to patient empowerment			upload, enter, view, and edit various health data (e.g., symptoms, medications, diagnoses, test results, and body measurements). It also provided features such as electronic messaging, video conferencing, and file management.				<p>heavily on patient's and perceived competency, autonomy, and relatedness</p> <p>- Failure of the system in its chronic context to meet the needs of patients and caregivers followed by avoidance coping strategies, their chronic condition, which typically involved suppression of the condition, disengagement from chronic care</p> <p>- The avoidance-oriented perspective of the system necessitated necessary coordination of communication with clinical team, not use it compared to the approach people would have found to use the system to help with symptoms and food intake, and food investigation results.</p>
Hazara and Bhandari (2016) (45)	To evaluate the characteristics and experiences of those patients who have registered for renal patient view but were inactive in using it.	Mixed	The UK	A renal patient view that is a secure website to view and monitor lab results, to document and monitor certain health parameters that of interests for their renal care providers e.g., weight, blood pressure, blood glucose and medications. It also includes educational materials	Tethered	Adult renal chronic patients	69 chronic renal patients	<p>- Main reason for being in-a-mentioned was difficulties with computer password followed by perception that the system did not add a members relationship with renal team</p> <p>- Other reasons were too busy, anxious with results or website not working</p> <p>- No need for website due to satisfactory routine care with the renal team</p>
Graetz et al. (2016) (46)	To understand whether socio-demographic differences in patient portal use for secure messaging can be explained by differences in internet access and care preferences.	Quantitative	The USA	A patient portal allowing users to view lab test results, order prescription medication refills, schedule nonurgent primary care visits, view after-visit summaries, and exchange secure electronic messages with their health care providers.	Tethered	Adult patients with asthma, coronary artery disease, congestive heart	1041 patients aged 18 or older who had at least one of the following chronic conditions of asthma, coronary artery disease, congestive heart failure, diabetes, or hypertension	<p>- Without internet access for internal care preferred by patients was male, older or black, lower income, a lower education level, and a statistically significant interaction to have used the portal to send a message who were younger, male, lower income, a lower education level</p> <p>- Frequency of access was higher with higher education level</p>

								<ul style="list-style-type: none"> - Patients reported for getting person or phone ins online we to report the portal secure m (P<0.001
Ryan et al. (2016) (47)	To explore the feelings, ideas and expectations of patients and primary care providers concerning both the implementation and the use of patient portals.	Qualitative	Canada	Without a patient portal/patient portal in general	Not applicable	Adult patients with diabetes, hypertension, asthma, obesity, COPD, thyroid condition, hyperlipidemia and cancer.	7 patients and 4 providers (i.e., two family physicians, one nurse practitioner and one family practice nurse)	<ul style="list-style-type: none"> - Challenge problema related to accessibil portals re computer the cost c (especially need to p on provid the prima patient-pr relationsl and trust entered b privacy a confident informati patients t and interj content o
Arcury et al. (2017) (48)	To determine potentially modifiable factors affecting patient portal utilization by older adults who receive care at clinics that serve low income and ethnically diverse communities.	Quantitative	The USA	The patient portal systems of the urban and rural clinics differed; but included viewing test results, sending a message to doctors or nurses, refilling prescriptions, making or changing an appointment, requesting a referral, finding information about a health issue, and other	Tethered	Adult patients with diabetes, hypertension, dyslipidemia, or cardiovascular disease	100 patients with diabetes, hypertension, dyslipidemia, or cardiovascular disease	<ul style="list-style-type: none"> - Patient utilization differ by age or ge - Poverty associate patient po utilization those below poverty le those at 1 % of the p and 53.1% above 200 poverty le utilized th portal - Those w than a hig education odds of p utilization - Those w currently lesser od portal util - Receivin urban clir increased patient po utilization -Those wi health uti patient po - More mi participar than whit (62.5%) h utilized th portal - Lesser e literacy w associate patient no their port -Those wi e-devices in their ho vs 1.2%), Internet e a day (47 and who e stress wh computer

								11.3% who at least so were more utilize the portal.
Sieck et al. (2017) (49)	To examine the following research question: "Within primary care offices with high rates of patient-portal use, what do experienced physician and patient users of the ambulatory portal perceive as the benefits and challenges of portal use in general and secure messaging in particular?"	Qualitative	The USA	MyChart, an interactive patient portal allowed viewing demographics and test and lab results Capabilities: schedule appointments, request refills and send secure messages to providers.	Tethered	Adult patients with at least one cardiopulmonary condition	13 Family Medicine providers in the department of Family Medicine and 29 of their patients who had at least one chronic condition.	<ul style="list-style-type: none"> - Concern imposing physician of provide reimburse interactio - Uncertainty by both patients & patient self messaging PHR (e.g. clarity about send a secure message; about unf sufficient informatio messages inappropriate topics, an use of the messaging
Cerdan et al. (2017) (50)	To gain insight into the experiences of patients with long-term conditions enrolled in an online rehabilitation program using a web portal.	Qualitative	Denmark	The Digital patient booklet, a patient portal for rehabilitation with supportive information and exercise programs for self-management activities	Not documented	Adults patients with heart disease, lymphedema and chronic pulmonary obstructive disease	Patients with heart disease, lymphedema and chronic pulmonary obstructive disease	<ul style="list-style-type: none"> - Patients personal physician physiothe - Technical regarding content, c sounds, a terminology non-native - Negative towards I negative i their rece care and i of confusi misunder and contr messages providers their diag
Tieu et al. (2017) (51)	To examine specific usability barriers to patient portal engagement among a diverse group of patients and caregivers.	Mixed	The USA	Web-based PHR with links to online health education library; allows viewing visit summaries, prescribed health education, test results and looking up general health information	Tethered	Adult patients with diabetes, hypertension, asthma or COPD, heart disease, heart failure or chronic kidney disease	Patients with diabetes, hypertension, asthma or COPD, heart disease, heart failure or chronic kidney disease and their caregivers and 2 care providers	<ul style="list-style-type: none"> - Basic, h computer challenge difficulty understan non-health medical b interpret treatment test resul inexperience search ba resource (URLs), c while nav portal
Williamson et al. (2017) (52)	To characterize how young adult survivors and parent proxies of survivors <18 years old use a PHR	Quantitative	The USA	SurvivorLink, a web-based PHR allowing users to upload and store important health documents and electronically share these documents with their providers independent of institutional or practice specific electronic medical records systems	Stand alone	Pediatric cancer patients	Patients with cancer and their parents	<ul style="list-style-type: none"> - Black PI registrant/ significant to use the SurvivorL meaningful - Young a registrant/ old) or th transition observati were sign more like SurvivorL meaningful comparec 18 (with t parent us
Peremislov (2017) (53)	To explore electronic communication (e-	Qualitative	The USA	A patient portal allowing patient-provider e-	Tethered	Adult type 2 diabetes	Patients with type 2 diabetes	<ul style="list-style-type: none"> - Of 71 e-communic

	communication or e-message encounter) between patients with type 2 diabetes and their providers within the patient portal.			communication (no further details were documented)		patients		initiated 149.2 % w primary c (PCP) sta from PCP care coor 2.8% from pharmacist from diab staff and specialty members
Price-Haywood et al. (2017) (54)	To examined the relationship between health literacy, portal use status, and interest in using websites or smartphone applications for tracking health information and to identify specific facilitators and barriers to use the portal.	Quantitative	The USA	*The patient portal of Epic systems called "MyOchsner" allowing patients to securely schedule/cancel non-urgent appointments, request medication refills, send and receive secure messages, view/download their health records, and access medical tools (e.g., wireless or patient-entered flow sheet data)	Tethered	Adult patients with hypertension and/or diabetes	247 patients with hypertension and/or diabetes	<ul style="list-style-type: none"> - Despite having access to computer phones, a Internet c (>70%), 1 nonusers frequently preferenc communic most com for not us (75%). - Compar nonusers, proportio rated por useful. - e-health positively with high and negat associate The odds usage inc total e-he and decre black pati odds of b intereste websites/ apps incr total e-he - Portal n mostly ex concerns security c informati personali using tecl of resour for skills support to computer Internet, not seeing for or val the portal their heal - There w among us computer cumbersc logging in accounts remembe password accounts in the sam household technical variations availabilit appointm schedulin response medical n - Patient l Advisory l identified clear tanq incentive the portal suppleme traditiona

								patient re a major a concern f nonusers
Price-Haywood et al. (2018) (55)	To examine whether the intensity of bidirectional secure portal messaging is associated with improved clinical outcomes.	Quantitative	The USA	*The patient portal of Epic systems called "MyOchsner" allowing patients to securely schedule/cancel non-urgent appointments, request medication refills, send and receive secure messages, view/download their health records, and access medical tools (e.g., wireless or patient-entered flow sheet data)	Tethered	Adult patients with hypertension or diabetes	Patients with hypertension or diabetes	- A higher of patient age 50 ye older, fen non-Hispa co-morbic and hypei higher fre intensity i advice me - Compar nonusers, were you higher pr were fem zip code i higher av household and were commerci Among po there wer proportio non-Hispa and lower Charlson scores
Ali et al. (2018) (56)	To identify task-technology fit problems and usability challenges in the novel portal, recommend solutions, and to evaluate whether the recommended design changes improved usability	Mixed	The USA	"myNYP" (New York Presbyterian), an electronic patient portal providing patients with inpatient data such as laboratory results, procedures, and care instructions after their hospital discharge	Tethered	Adults chronic patients	23 participants which consisted of patients with chronic conditions including types I and II diabetes, and cancer, and also caregivers caring for family members with conditions such as ulcerative colitis and thalassemia	- A numbe barriers (e use users' insufficien the portal - Mismatch users, tasl technolog a very con understan informatio managem - Problem consolidat medical re scattered multiple d sharing th
van den Heuvel et al. (2018) (57)	Primary objectives: To test the feasibility of a PHR for bipolar patients To evaluate the user experiences of persons with bipolar disorders (BD) involving informal caregivers, and clinicians. The secondary objective: To examine changes in quality of life, empowerment, symptom reduction, changes in mood and activity, and illness burden and severity.	Quantitative	The Netherlands	A Web-based online personal health record Allowing to view medical record, medication, treatment, and medical passport, laboratory results and reports, mood chart, general information about the features of BD Capabilities: a personal messages module to communicate with the appointed clinician and a personal crisis plan from interpretation of mood chart	Untethered	Adult bipolar disorder patients	66 patients with diagnosis of bipolar disorders and eleven clinicians (e.g., psychiatrists, advanced nurse practitioners, and community psychiatric nurses)	- Over a t clinicians direct tele contact in communic through F concern t communic distorted commun decrease responsib participar get in cor appropri - From the participar responde endpoint, the follow for dropp PHRBD w work, the perceive t value, we and felt to when mor course of - Some cli (32.1%) d with infor caregiver PHR due about imp privacy of might be and migh communic between]

								<p>about the prematur</p> <p>- A lack of compatibility existing between electronic record systems using the function (copy and paste) from the system in BD and vi which was too time-consuming and unfree daily practice</p>
Latulipe et al. (2018) (58)	To examine how older adult patients perceive the benefits and risks of proxy patient portal access by their caregivers.	Qualitative	The USA	A patient portal (no details available)	Not documented	Adult patients with diabetes, hypertension, dyslipidemia, or cardiovascular disease	10 patients with diabetes, hypertension, dyslipidemia, or cardiovascular disease	<p>- Concern privacy of information; stigmatization existed on confidential financial information</p>
Nahm et al. (2018) (59)	To examine the current state of older chronic patients' patient portal use and their experiences with patient portal training	Mixed	The USA	At least 38 different patient portals across the country	Not applicable	Adult patients with at least one chronic disease including hypertension, arthritis, depression, and others	Patient with at least one chronic disease including hypertension, arthritis, depression, and others	<p>- Participated in knowledge efficacy for relatively average F of 5.2 ± 1 mean self PP use of</p> <p>- Having 1 portals for providers remember one was for provider</p> <p>- Participated perceived their portal if they had was low, of 28.7</p>
Powell and Myers (2018) (60)	To explore how patients are introduced to and learn about portals and how patients and providers perceive the usefulness of a portal in the context of chronic illness self-management.	Qualitative	The USA	Web based electronic patient portals in general	Not applicable	Adult patients with multiple chronic conditions (diabetes, hypertension, heart disease, or coronary artery disease)	9 patients and 7 healthcare providers	<p>- Difficulty with the portal password or server identified by both patients and providers</p> <p>- Unavailable such as computer errors in changing pharmacy</p> <p>- Many patients providers their preferred interaction person rather than the portal</p> <p>- A number specific to three sub lack of time concerns, regulator</p> <p>- Multiple mentioned for payment specific payments providers compensation work via</p>

Abbreviations: personal health records (PHR), electronic medical record (EMR), electronic health record (EHR), chronic kidney disease (CKD), Odds Ratio (OR) chronic obstructive pulmonary disease (COPD), bipolar disorders (BD), human immunodeficiency virus (HIV), my health profile (MGP), the United States of America (the USA), the United Kingdom (the UK),

*data was completed using the authors' another publication i.e., "Primary Care Practice Reengineering and Associations With Patient Portal Use, Service Utilization, and Disease Control Among Patients With Hypertension and/or Diabetes"; Ochsner J. 2017 Spring; 17(1): 103-111.

References:

1. Lober WB, Zierler B, Herbaugh A, Shinstrom SE, Stolyar A, Kim EH, et al. Barriers to the use of a personal health record by an elderly population. AMIA Annual Symposium proceedings AMIA Symposium. 2006;514-8. PubMed PMID: 17238394. Pubmed Central PMCID: 1839577.
2. Hess R, Bryce CL, Paone S, Fischer G, McTigue KM, Olshansky E, et al. Exploring challenges and potentials of personal health records in diabetes self-management: implementation and initial assessment. Telemedicine journal and e-health : the official journal of the American Telemedicine Association. 2007 Oct;13(5):509-17. PubMed PMID: 17999613. Epub 2007/11/15. eng.
3. Zickmund SL, Hess R, Bryce CL, McTigue K, Olshansky E, Fitzgerald K, et al. Interest in the use of computerized patient portals: role of the provider-patient relationship. Journal of general internal medicine. 2008 Jan;23 Suppl 1:20-6. PubMed PMID: 18095039. Pubmed Central PMCID: PMC2338160. Epub 2008/01/10. eng.
4. Britto MT, Jimison HB, Munafo JK, Wissman J, Rogers ML, Hersh W. Usability testing finds problems for novice users of pediatric portals. Journal of the American Medical Informatics Association : JAMIA. 2009 Sep-Oct;16(5):660-9. PubMed PMID: 19567793. Pubmed Central PMCID: PMC2744717. Epub 2009/07/02. eng.
5. Kim EH, Stolyar A, Lober WB, Herbaugh AL, Shinstrom SE, Zierler BK, et al. Challenges to using an electronic personal health record by a low-income elderly population. Journal of medical Internet research. 2009 Oct 27;11(4):e44. PubMed PMID: 19861298. Pubmed Central PMCID: 2802566.
6. Sarkar U, Karter AJ, Liu JY, Adler NE, Nguyen R, Lopez A, 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). Journal of health communication. 2010;15 Suppl 2:183-96. PubMed PMID: 20845203. Pubmed Central PMCID: PMC3014858. Epub 2010/09/29. eng.
7. Weppner WG, Ralston JD, Koepsell TD, Grothaus LC, Reid RJ, Jordan L, et al. Use of a shared medical record with secure messaging by older patients with diabetes. Diabetes care. 2010 Nov;33(11):2314-9. PubMed PMID: 20739686. Pubmed Central PMCID: PMC2963486. Epub 2010/08/27. eng.
8. Wagner PJ, Howard SM, Bentley DR, Seol YH, Sodomka P. Incorporating patient perspectives into the personal health record: implications for care and caring. Perspectives in health information management. 2010 Oct 1;7:1e. PubMed PMID: 21063546. Pubmed Central PMCID: 2966356.
9. Nordfeldt S, Hanberger L, Bertero C. Patient and parent views on a Web 2.0 Diabetes Portal--the management tool, the generator, and the gatekeeper: qualitative study. Journal of medical Internet research. 2010 May 28;12(2):e17. PubMed PMID: 20511179. Pubmed Central PMCID: PMC2956228. Epub 2010/06/01. eng.
10. Goel MS, Brown TL, Williams A, Cooper AJ, Hasnain-Wynia R, Baker DW. Patient reported barriers to enrolling in a patient portal. Journal of the American Medical Informatics Association : JAMIA. 2011 Dec;18 Suppl 1:i8-12. PubMed PMID: 22071530. Pubmed Central PMCID: PMC3241181. Epub 2011/11/11. eng.
11. Tenforde M, Nowacki A, Jain A, Hickner J. The association between personal health record use and diabetes quality measures. Journal of general internal medicine. 2012 Apr;27(4):420-4. PubMed PMID: 22005937. Pubmed Central PMCID: 3304034.
12. Sarkar U, Karter AJ, Liu JY, Adler NE, Nguyen R, Lopez A, et al. Social disparities in internet patient portal use in diabetes: evidence that the digital divide extends beyond access. Journal of the American Medical Informatics Association : JAMIA. 2011 May 1;18(3):318-21. PubMed PMID: 21262921. Pubmed Central PMCID: 3078675.
13. Nielsen AS, Halamka JD, Kinkel RP. Internet portal use in an academic multiple sclerosis center. Journal of the American Medical Informatics Association : JAMIA. 2012 Jan-Feb;19(1):128-33. PubMed PMID: 21571744. Pubmed Central PMCID: 3240754.
14. Wagner PJ, Dias J, Howard S, Kintziger KW, Hudson MF, Seol YH, et al. Personal health records and hypertension control: a randomized trial. Journal of the American Medical Informatics Association : JAMIA. 2012 Jul-Aug;19(4):626-34. PubMed PMID: 22234404. Pubmed Central PMCID: 3384099.
15. Day K, Gu Y. Influencing factors for adopting personal health record (PHR). Studies in health technology and informatics. 2012;178:39-44. PubMed PMID: 22797017. Epub 2012/07/17. eng.
16. Emani S, Yamin CK, Peters E, Karson AS, Lipsitz SR, Wald JS, et al. Patient perceptions of a personal health record: a test of the diffusion of innovation model. Journal of medical Internet research. 2012 Nov 5;14(6):e150. PubMed PMID: 23128775. Pubmed Central PMCID: 3517342.
17. Tom JO, Mangione-Smith R, Solomon C, Grossman DC. Integrated personal health record use: association with parent-reported care experiences. Pediatrics. 2012 Jul;130(1):e183-90. PubMed PMID: 22689872. Epub 2012/06/13. eng.
18. Urowitz S, Wiljer D, Dupak K, Kuehner Z, Leonard K, Lovrics E, et al. Improving diabetes management with a patient portal: a qualitative study of diabetes self-management portal. Journal of medical Internet research. 2012 Nov 30;14(6):e158. PubMed PMID: 23195925. Pubmed Central PMCID: PMC3510725. Epub 2012/12/01. eng.
19. Gordon P, Camhi E, Hesse R, Odlum M, Schnall R, Rodriguez M, et al. Processes and outcomes of developing a continuity of care document for use as a personal health record by people living with HIV/AIDS in New York City. International journal of medical informatics. 2012 Oct;81(10):e63-73. PubMed PMID: 22841825. Pubmed Central PMCID: 4447096.
20. Logue MD, Effken JA. An exploratory study of the personal health records adoption model in the older adult with chronic illness. Informatics in primary care. 2012;20(3):151-69. PubMed PMID: 23710840. Epub 2012/01/01. eng.

21. Britto MT, Hesse EA, Kamdar OJ, Munafo JK. Parents' perceptions of a patient portal for managing their child's chronic illness. *The Journal of pediatrics*. 2013 Jul;163(1):280-1.e1-2. PubMed PMID: 23541773. Epub 2013/04/02. eng.
22. Osborn CY, Mayberry LS, Wallston KA, Johnson KB, Elasy TA. Understanding patient portal use: implications for medication management. *Journal of medical Internet research*. 2013 Jul 3;15(7):e133. PubMed PMID: 23823974. Pubmed Central PMCID: 3713921.
23. Ronda MC, Dijkhorst-Oei LT, Gorter KJ, Beulens JW, Rutten GE. Differences between diabetes patients who are interested or not in the use of a patient Web portal. *Diabetes technology & therapeutics*. 2013 Jul;15(7):556-63. PubMed PMID: 23777369. Pubmed Central PMCID: PMC3709590. Epub 2013/06/20. eng.
24. Wade-Vuturo AE, Mayberry LS, Osborn CY. Secure messaging and diabetes management: experiences and perspectives of patient portal users. *Journal of the American Medical Informatics Association : JAMIA*. 2013 May 1;20(3):519-25. PubMed PMID: 23242764. Pubmed Central PMCID: PMC3628058. Epub 2012/12/18. eng.
25. Lyles CR, Sarkar U, Ralston JD, Adler N, Schillinger D, Moffet HH, et al. Patient-provider communication and trust in relation to use of an online patient portal among diabetes patients: The Diabetes and Aging Study. *Journal of the American Medical Informatics Association : JAMIA*. 2013 Nov-Dec;20(6):1128-31. PubMed PMID: 23676243. Pubmed Central PMCID: 3822118.
26. Pai HH, Lau F, Barnett J, Jones S. Meeting the health information needs of prostate cancer patients using personal health records. *Current oncology (Toronto, Ont)*. 2013 Dec;20(6):e561-9. PubMed PMID: 24311957. Pubmed Central PMCID: PMC3851353. Epub 2013/12/07. eng.
27. Martinez M, Baum A, Gomez Saldano AM, Gomez A, Luna D, Gonzalez Bernaldo de Quiros F. Predictive variables of the use of personal health record: the Hospital Italiano de Buenos Aires study. *Studies in health technology and informatics*. 2013;192:1171. PubMed PMID: 23920945. Epub 2013/08/08. eng.
28. Luque AE, van Keken A, Winters P, Keefer MC, Sanders M, Fiscella K. Barriers and Facilitators of Online Patient Portals to Personal Health Records Among Persons Living With HIV: Formative Research. *JMIR research protocols*. 2013 Jan 22;2(1):e8. PubMed PMID: 23612564. Pubmed Central PMCID: 3628162.
29. Byczkowski TL, Munafo JK, Britto MT. Family perceptions of the usability and value of chronic disease web-based patient portals. *Health informatics journal*. 2014 Jun;20(2):151-62. PubMed PMID: 24056751. Epub 2013/09/24. eng.
30. Fiks AGMDM, Mayne SMHS, Karavite DJMSI, DeBartolo EBS, Grundmeier RWMD. A Shared e-Decision Support Portal for Pediatric Asthma. [Article]: *Journal of Ambulatory Care Management* April/June 2014;37(2):120-126; 2014.
31. Sharp LK, Carvalho P, Southward M, Schmidt ML, Jabine LN, Stolley MR, et al. Electronic Personal Health Records for Childhood Cancer Survivors: An Exploratory Study. *Journal of adolescent and young adult oncology*. 2014 Sep 1;3(3):117-22. PubMed PMID: 25276495. Pubmed Central PMCID: PMC4171113. Epub 2014/10/03. eng.
32. Odum M, Gordon P, Camhi E, Valdez E, Bakken S. Exploring factors related to the adoption and acceptance of an internet-based electronic personal health management tool (EPHMT) in a low income, special needs population of people living with HIV and AIDS in New York City. *Studies in health technology and informatics*. 2014;201:145-52. PubMed PMID: 24943537. Epub 2014/06/20. eng.
33. Barron J, Bedra M, Wood J, Finkelstein J. Exploring three perspectives on feasibility of a patient portal for older adults. *Studies in health technology and informatics*. 2014;202:181-4. PubMed PMID: 25000046. Epub 2014/07/08. eng.
34. Baudendistel I, Winkler E, Kamradt M, Langst G, Eckrich F, Heinze O, et al. Personal electronic health records: understanding user requirements and needs in chronic cancer care. *Journal of medical Internet research*. 2015 May 21;17(5):e121. PubMed PMID: 25998006. Pubmed Central PMCID: PMC4468571. Epub 2015/05/23. eng.
35. Gartrell K, Storr CL, Trinkoff AM, Wilson ML, Gurses AP. Electronic personal health record use among registered nurses. *Nursing outlook*. 2015 May-Jun;63(3):278-87. PubMed PMID: 25982768. Pubmed Central PMCID: PMC4438260. Epub 2015/05/20. eng.
36. Gee PM, Paterniti DA, Ward D, Soederberg Miller LM. e-Patients Perceptions of Using Personal Health Records for Self-management Support of Chronic Illness. *Computers, informatics, nursing : CIN*. 2015 Jun;33(6):229-37. PubMed PMID: 25899440. Epub 2015/04/23. eng.
37. Harrison TG, Wick J, Ahmed SB, Jun M, Manns BJ, Quinn RR, et al. Patients with chronic kidney disease and their intent to use electronic personal health records. *Canadian journal of kidney health and disease*. 2015;2:23. PubMed PMID: 26075082. Pubmed Central PMCID: PMC4465011. Epub 2015/06/16. eng.
38. Nippak PMD, Isaac WW, Geertsen A, Ikeda-Douglas CJ. Family attitudes towards an electronic personal health record in a long term care facility. *Journal of Hospital Administration*. 2015;4(3):9-19.
39. Tieu L, Sarkar U, Schillinger D, Ralston JD, Ratanawongsa N, Pasick R, et al. Barriers and Facilitators to Online Portal Use Among Patients and Caregivers in a Safety Net Health Care System: A Qualitative Study. *Journal of medical Internet research*. 2015 Dec 3;17(12):e275. PubMed PMID: 26681155. Pubmed Central PMCID: PMC4704882. Epub 2015/12/19. eng.
40. Wells S, Rozenblum R, Park A, Dunn M, Bates DW. Organizational strategies for promoting patient and provider uptake of personal health records. *Journal of the American Medical Informatics Association : JAMIA*. 2015 Jan;22(1):213-22. PubMed PMID: 25326601. Pubmed Central PMCID: PMC4433381. Epub 2014/10/19. eng.
41. Latulipe C, Gatto A, Nguyen HT, Miller DP, Quandt SA, Bertoni AG, et al. Design Considerations for Patient Portal Adoption by Low-Income, Older Adults. *Proceedings of the SIGCHI conference on human factors in computing systems CHI Conference*. 2015 Apr;2015:3859-68. PubMed PMID: 27077140. Pubmed Central PMCID: PMC4827765. Epub 2016/04/15. eng.
42. Smith SG, O'Connor R, Aitken W, Curtis LM, Wolf MS, Goel MS. Disparities in registration and use of an online patient portal among older adults: findings from the LitCog cohort. *Journal of the American Medical Informatics Association : JAMIA*. 2015 Jul;22(4):888-95. PubMed PMID: 25914099. Pubmed Central PMCID: PMC4810779. Epub 2015/04/29. eng.

43. Eschler J, Meas PL, Lozano P, McClure JB, Ralston JD, Pratt W. Integrating the patient portal into the health management work ecosystem: user acceptance of a novel prototype. *AMIA Annual Symposium proceedings AMIA Symposium*. 2016;2016:541-50. PubMed PMID: 28269850. Pubmed Central PMCID: PMC5333335. Epub 2017/03/09. eng.
44. Schneider H, Hill S, Blandford A. Patients Know Best: Qualitative Study on How Families Use Patient-Controlled Personal Health Records. *Journal of medical Internet research*. 2016 Feb 24;18(2):e43. PubMed PMID: 26912201. Pubmed Central PMCID: PMC4785240. Epub 2016/02/26. eng.
45. Hazara AM, Bhandari S. Barriers to patient participation in a self-management and education website Renal PatientView: A questionnaire-based study of inactive users. *International journal of medical informatics*. 2016 Mar;87:10-4. PubMed PMID: 26806707. Epub 2016/01/26. eng.
46. Graetz I, Gordon N, Fung V, Hamity C, Reed ME. The Digital Divide and Patient Portals: Internet Access Explained Differences in Patient Portal Use for Secure Messaging by Age, Race, and Income. *Medical care*. 2016 Aug;54(8):772-9. PubMed PMID: 27314262. Epub 2016/06/18. eng.
47. Ryan BL, Brown JB, Terry A, Cejic S, Stewart M, Thind A. Implementing and Using a Patient Portal: A qualitative exploration of patient and provider perspectives on engaging patients. *Journal of innovation in health informatics*. 2016 Jul 4;23(2):848. PubMed PMID: 27869582. Epub 2016/11/22. eng.
48. Arcury TA, Quandt SA, Sandberg JC, Miller DP, Jr., Latulipe C, Leng X, et al. Patient Portal Utilization Among Ethnically Diverse Low Income Older Adults: Observational Study. *JMIR medical informatics*. 2017 Nov 14;5(4):e47. PubMed PMID: 29138129. Pubmed Central PMCID: PMC5705857. Epub 2017/11/16. eng.
49. Sieck CJ, Hefner JL, Schnierle J, Florian H, Agarwal A, Rundell K, et al. The Rules of Engagement: Perspectives on Secure Messaging From Experienced Ambulatory Patient Portal Users. *JMIR medical informatics*. 2017 Jul 4;5(3):e13. PubMed PMID: 28676467. Pubmed Central PMCID: PMC5516097. Epub 2017/07/06. eng.
50. Cerdan J, Catalan-Matamoros D, Berg SW. Online communication in a rehabilitation setting: Experiences of patients with chronic conditions using a web portal in Denmark. *Patient education and counseling*. 2017 Dec;100(12):2283-9. PubMed PMID: 28698033. Epub 2017/07/13. eng.
51. Tieu L, Schillinger D, Sarkar U, Hoskote M, Hahn KJ, Ratanawongsa N, et al. Online patient websites for electronic health record access among vulnerable populations: portals to nowhere? *Journal of the American Medical Informatics Association : JAMIA*. 2017 Apr 1;24(e1):e47-e54. PubMed PMID: 27402138. Pubmed Central PMCID: PMC6080722. Epub 2016/07/13. eng.
52. Williamson RS, Cherven BO, Gilleland Marchak J, Edwards P, Palgon M, Escoffery C, et al. Meaningful Use of an Electronic Personal Health Record (ePHR) among Pediatric Cancer Survivors. *Applied clinical informatics*. 2017 Mar 15;8(1):250-64. PubMed PMID: 28293684. Pubmed Central PMCID: PMC5373768. Epub 2017/03/16. eng.
53. Peremislov D. Patient Use of the Electronic Communication Portal in Management of Type 2 Diabetes. *Computers, informatics, nursing : CIN*. 2017 Sep;35(9):473-82. PubMed PMID: 28323648. Epub 2017/03/23. eng.
54. Price-Haywood EG, Harden-Barrios J, Ulep R, Luo Q. eHealth Literacy: Patient Engagement in Identifying Strategies to Encourage Use of Patient Portals Among Older Adults. *Population health management*. 2017 Dec;20(6):486-94. PubMed PMID: 28384076. Epub 2017/04/07. eng.
55. Price-Haywood EG, Luo Q, Monlezun D. Dose effect of patient-care team communication via secure portal messaging on glucose and blood pressure control. *Journal of the American Medical Informatics Association : JAMIA*. 2018 Jun 1;25(6):702-8. PubMed PMID: 29444256. Epub 2018/02/15. eng.
56. Ali SB, Romero J, Morrison K, Hafeez B, Ancker JS. Focus Section Health IT Usability: Applying a Task-Technology Fit Model to Adapt an Electronic Patient Portal for Patient Work. *Applied clinical informatics*. 2018 Jan;9(1):174-84. PubMed PMID: 29539648. Pubmed Central PMCID: PMC5851788. Epub 2018/03/15. eng.
57. van den Heuvel SCGH, Meije D, Regeer EJ, Sinnema H, Riemersma RF, Kupka RW. The user experiences and clinical outcomes of an online personal health record to support self-management of bipolar disorder: A pretest-posttest pilot study. *Journal of Affective Disorders*. 2018 2018/10/01;238:261-8.
58. Latulipe C, Quandt SA, Melius KA, Bertoni A, Miller DP, Jr., Smith D, et al. Insights Into Older Adult Patient Concerns Around the Caregiver Proxy Portal Use: Qualitative Interview Study. *Journal of medical Internet research*. 2018 Nov 2;20(11):e10524. PubMed PMID: 30389654. Pubmed Central PMCID: PMC6240158. Epub 2018/11/06. eng.
59. Nahm ES, Zhu S, Bellantoni M, Keldsen L, Charters K, Russomanno V, et al. Patient Portal Use Among Older Adults: What Is Really Happening Nationwide? *Journal of applied gerontology : the official journal of the Southern Gerontological Society*. 2018 May 1;733464818776125. PubMed PMID: 29779422. Epub 2018/05/22. eng.
60. Electronic Patient Portals: Patient and Provider Perceptions [Internet]. 2018 [cited 15th, April 2008]. Available from: <http://www.himss.org/ojni>.

[1] In the chronological order of publication year

Table 2. Barriers to the adoption and use of care providers on the basis of the UTAUT

Factors ^[1]	Citations
Healthcare provider characteristics	
IT experience and knowledge, years in practice, role, age, gender, race	---
Medical practice characteristics	
Practice size, teaching status, location, single-multispecialty, practice level, types of third party payers, patient age range	---
Voluntariness of use	
Perceived voluntariness	---
Performance expectancy	
Perceived usefulness and needs	Physician resistance due to concerns about the impact on their patients (2) Need to meet provider requirements for example by a structure to facilitate tracking the course of illness and treatment over time; highlight important or new information with color or a priority for current issues; include a basic dataset of relevant information that would be crucial for everyone involved in the patients' health care with manageable volume of information (3)
Relative advantage	---
Job-fit	Provider concern on overreliance of patients on portals when exacerbations in their condition occur (4) ; provider belief that patients should view PHRs as access to care for chronic condition and not for an acute flare in their condition (5) ; uncertainty about how the patient should use the messaging function of PHR to communicate with providers (6)
Reimbursement and financial incentives ^α	Concerns about lack of provider reimbursement for provider interactions via the portal and discussions around how to better reimburse for interactions (1,5,7)
Effort expectancy	
Perceived ease of use	Concerns on system interface that need to be simple and the content be clear (5) ; provider concerns on the ability of patients to understand and interpret the content of portals (7)
Ease of use	---
Complexity	---
Social influence	
Subjective norms competition, supportive organizational culture for change, friendship networks,	---
Facilitating or inhibiting conditions	
Computer self-efficacy	---
Computer anxiety	---
Legal concern	Physician concern and uncertainty regarding negative consequences on professionals' liability for reacting to patient-added information or commentaries when several physicians from different healthcare settings would have PHR access (3)
Financial constraints ^β	---
Availability of ICT infrastructure	Difficulty accessing the portal due to computer or server problems (8)
Time cost	Impact on provider workload and the required provider duplicate time and efforts to handle issues related to the PHR use parallel to those in the office time (1,3,5,6,7)
Interoperability	A lack of compatibility with existing hospital electronic medical record systems (9)
IT support	---
eHealth and business process alignment	A number of regulatory barriers causing provider frustration for example by the amount of data required to be monitored for insurance services, as well as by being told how to practice (8)
End user involvement	---
Management commitment and support for change	---
Uncertainty about IT vendor	---
Professional autonomy	Honesty and trust of provides on the data entered by patients (7)
Interference with healthcare provider-patient relationship	The primacy of (and preference for) direct patient-provider relationship particularly in special circumstances (6,7,8)
Patient privacy concerns	Provider concerns on the privacy and confidentiality of patient information (6,8)

Note: Only 9 out of 60 identified studies involved care providers as study participants to evaluate PHR adoption barriers faced specifically by providers.

^α the degree of a healthcare provider's perception of uncertainty over return on monetary investment (according to Li et al. Interactive journal of medical research 2013;2;1/e7)

^β the degree of a healthcare provider's perception of high monetary cost for adopting eHealth system (i.e., start-up costs and ongoing maintenance costs, and the availability of financial resources to cover the cost (according to Li et al. Interactive journal of medical research 2013;2;1/e7)

References

1. Venkatesh V, Morris MG, Davis GB, Davis FD. User Acceptance of Information Technology: Toward a Unified View. MIS Quarterly. 2003;27(3):425-78

2. Wells S, Rozenblum R, Park A, Dunn M, Bates DW. Organizational strategies for promoting patient and provider uptake of personal health records. Journal of the American Medical Informatics Association : JAMIA. 2015 Jan;22(1):213-22. PubMed PMID: 25326601. Pubmed Central PMCID: PMC4433381. Epub 2014/10/19. eng.

3. Baudendistel I, Winkler E, Kamradt M, Langst G, Eckrich F, Heinze O, et al. Personal electronic health records: understanding user requirements and needs in chronic cancer care. Journal of medical Internet research. 2015 May 21;17(5):e121. PubMed PMID: 25998006. Pubmed Central PMCID: PMC4468571. Epub 2015/05/23. eng.

4. Urowitz S, Wiljer D, Dupak K, Kuehner Z, Leonard K, Lovrics E, et al. Improving diabetes management with a patient portal: a qualitative study of diabetes self-management portal. Journal of medical Internet research. 2012 Nov 30;14(6):e158. PubMed PMID: 23195925. Pubmed Central PMCID: PMC3510725. Epub 2012/12/01. eng.

5. Fiks AGMDM, Mayne SMHS, Karavite DJMSI, DeBartolo EBS, Grundmeier RWMD. A Shared e-Decision Support Portal for Pediatric Asthma. [Article]: Journal of Ambulatory Care Management April/June 2014;37(2):120-126; 2014.

6. Sieck CJ, Hefner JL, Schnierle J, Florian H, Agarwal A, Rundell K, et al. The Rules of Engagement: Perspectives on Secure Messaging From Experienced Ambulatory Patient Portal Users. JMIR medical informatics. 2017 Jul 4;5(3):e13. PubMed PMID: 28676467. Pubmed Central PMCID: PMC5516097. Epub 2017/07/06. eng.

7. Ryan BL, Brown JB, Terry A, Cejic S, Stewart M, Thind A. Implementing and Using a Patient Portal: A qualitative exploration of patient and provider perspectives on engaging patients. Journal of innovation in health informatics. 2016 Jul 4;23(2):848. PubMed PMID: 27869582. Epub 2016/11/22. eng.

8. Electronic Patient Portals: Patient and Provider Perceptions [Internet]. 2018 [cited 15th, April 2008]. Available from: <http://www.himss.org/ojni>.

9. van den Heuvel SCGH, Meije D, Regeer EJ, Sinnema H, Riemersma RF, Kupka RW. The user experiences and clinical outcomes of an online personal health record to support self-management of bipolar disorder: A pretest-posttest pilot study. Journal of Affective Disorders. 2018 2018/10/01/;238:261-8.

[1] For details on the definition of factors, please refer to 1. Venkatesh V, Morris MG, Davis GB, Davis FD. User Acceptance of Information Technology: Toward a Unified View. MIS Quarterly. 2003;27(3):425-78

Figures

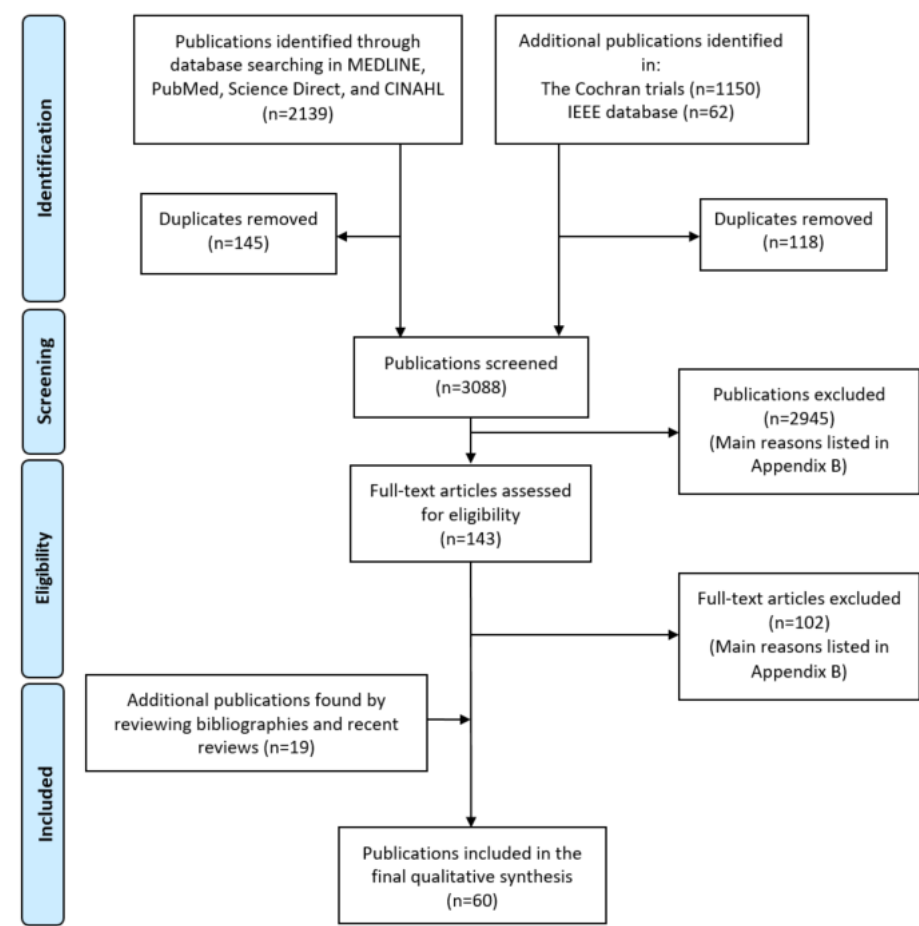


Figure 1
Flow diagram of study selection (literature search January 1, 2005 till December 31, 2018)

This is a list of supplementary files associated with this preprint. Click to download.

- [PRISMA2009checklist.doc](#)
- [SupplementaryfileAppendixA.docx](#)
- [SupplementaryfileAppendixB.docx](#)
- [SupplementaryfileAppendixC.docx](#)