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The functionalities and features of PHRs

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The Functionalities and Features of Personal Health Record Systems

Full research paper

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Abstract

This paper aims to investigate the up-to-date functions and features offered in PHR systems, that might affect PHRs adoption, engagement, and usability. Article search was conducted in the Scopus, Medline, and Web of Science databases and 19 articles were selected in the review based on the inclusion criteria. These studies examined PHRs (Personal Health Record system) functionality, features, and adoption by using different research methods. As a result of the review, PHRs functions were classified into 8 themes (personal information management, communication, medication, laboratory, appointment management, self-monitoring, education & advanced functions) which may impact patients' acceptance and usability of PHRs. It was found that system functionalities affect the utilisation of the patient portal, and PHRs adoption and usability significantly improves when users seek and use features.

Keywords: Personal Health Record, Patient Portal, Adoption, Engagement, Acceptance.

Introduction

A personal healthcare record (PHR) is an electronic medical record, accessible by the patients, that contains health information and other details about their medical care. Healthcare organisations store information via a connected patient portal, often known as a personal health record. These secure portals allow patients to have 24-hour online accessibility to their personal medical information, including current medical appointments, discharge summaries, prescriptions, allergies, immunizations, and lab results (Niazkhani et al. 2020). Some patient portals also provide options to book appointments, ask for medicine refills, and text or email their healthcare providers in a secure manner. In general, the purpose of PHR is to serve as a centralised platform that automatically offers users detailed and individualised healthcare information to make daily life activities easier (Luo et al. 2011). Patient portals have many advantages which include better accessibility to health information and services. They also include enhanced interaction with healthcare providers, higher levels of satisfaction and care quality, and increased motivation and self-assurance in managing one's health (Niazkhani et al. 2020). Especially for patients visiting several healthcare practitioners, tools like PHR can be useful in providing timely medical history of the patient, hence reducing the need for unnecessary test requests and medication prescriptions (Jian et al. 2012). PHR are self-managed and intended to encourage patient involvement in healthcare in addition to make vital patient information accessible throughout medical care sites (Kensing, F. 2012).

Patient portal adoption is driven by system functionality and usability. When users demand and use functionalities, this causes PHR usability to significantly increase (Pushpangadan et al. 2015). Personal health records should be adaptable, usable, comfortable, and familiar and therefore, patients using PHRs will be more actively participating in their treatment (Alsyouf et al. 2023). Personal health records have the capacity to allow patients to monitor and record personal health data, provide disease-specific information or instructions, encourage aspired changes in lifestyle, and provide client alerts for taking medications. Patients also benefit from customizable features and increased interaction between patients and providers (Coorey et al. 2019). A small amount clinical summary given to the patient following every visit, encrypted messaging (SM) between the patient and the provider, the capacity to examine, download, and transmit data from personal health records, patient-specific education, client alerts for preventative care, and reconciling medications are all features that have a direct connection to patient portal. PHR usability is essential for consumer acceptance and system functionality. PHRs must be simple for customers to use, quick to obtain, and with optimized effectiveness to encourage adoption.

Despite this, few analyses have found low adoption rates (Yousef et al. 2021). Based on research conducted by Abd-alrazaq et al. in 2019 and Powell, 2017, it has been observed that the adoption rates of Personal Health Record (PHR) systems are frequently low, despite their numerous potential benefits. In the United Kingdom and several other European countries including France, Denmark, and Estonia, the adoption rates of electronic PHRs were found to be less than 0.13% and only managed to reach a modest 5%, respectively (Abd-alrazaq et al. in 2019). Finding incentives for customers to use system information and make active decisions is also crucial (Koivumäki et al. 2017). It also affects the user's capacity to efficiently use portal features, accurately enter information, and interpret information provided. This influences how effective the portal is as a tool for consumer involvement (Irizarry et al. 2015). Additionally, PHR functions must be discussed frequently to maintain the research up to date because PHR features and functions are always changing (Harahap et al. 2020). Patient and provider acceptance will occur when the functionality and information requirements of both groups can be met by the capabilities already present in the patient portal (Irizarry et al. 2015). Several investigations demonstrated how PHRs were adopted or how consumer preferences affected PHR system usage. Nevertheless, there is limited evidence to the usefulness and functionality of patient portals or PHRs in studies. A study by Win, 2006, evaluated availability functions of web based personal health records and found family health history and vital statistics, health/medical condition and medication, immunisation, laboratory tests, alerts, emergency access to a PHR and record summary functions popular.

This paper aims to examine the novel functions available in the PHR systems. The purpose is to examine the crucial features and functions that could impact the acceptability of patient portals/PHRs and to investigate the adoption, engagement, and usability of PHRs and its functions. Various features and functions of the systems may influence the patients to be more interested in using and accepting the system. Therefore, the objective of this review is to identify the functions and features presented in personal health records that can improve the adoption and usability of PHRs.

Methods

For the purpose of the study, search of three online databases, Scopus, Web of Science and MEDLINE with Full Text, was conducted. The search terms used are: ("personal health record" OR "personal medical record" OR "patient portal" OR "personal health information" OR "personally controlled electronic health record" OR" personal health records" OR "personal health services" OR "computerized medical records systems" OR "consumer health information" OR "consumer health informatics") AND (adoption OR engagement OR acceptance).

In this review, Covidence tool was used for the article selection process. Based on the search keywords 134 articles were selected, of which 6 duplicate articles were eliminated, leaving 133 papers for the screening procedure. We evaluated each article eligibility as part of the screening procedure until agreement was obtained. After the initial screening (of the title and abstract), 30 articles were left for the next step of full-text assessment. The screening of the full text, excluded 11 articles (not matching the inclusion requirements), resulting in selection of 19 articles for the systematic literature review. The inclusion and exclusion criteria are presented in Table 1. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart is presented on Figure 1 (Parums 2021).
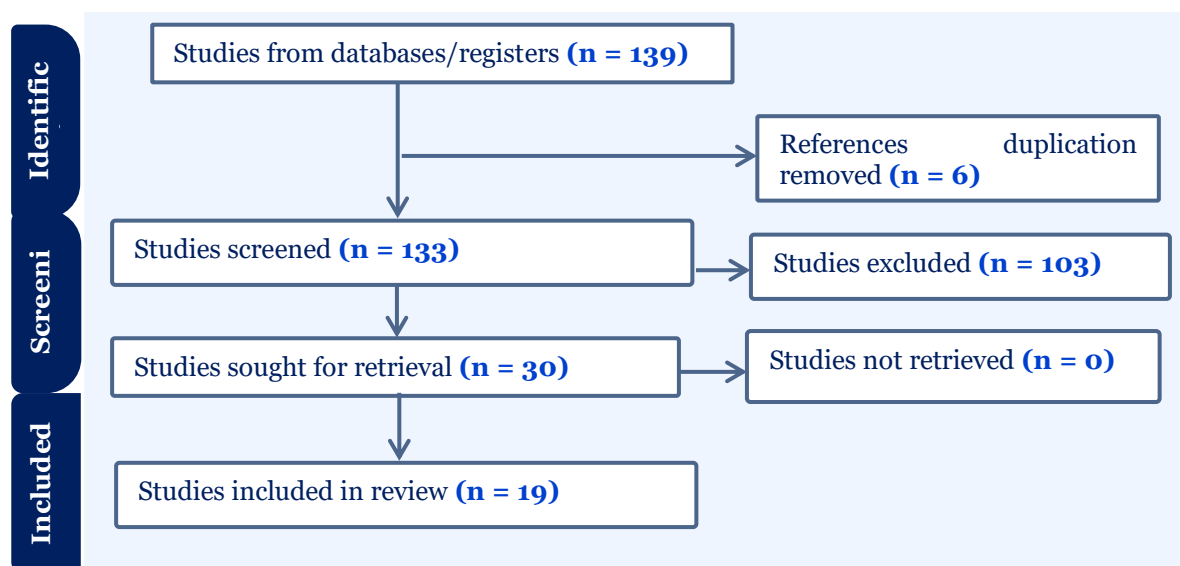

Figure 1: PRISMA Flowchart

A qualitative content analysis was conducted using NVivo software to determine PHR features and functions. Deductive and inductive methods were combined to create a coding strategy. Data collection and categorisation were done through the coding process in order to group segments that are related to one another. The features and functions of all retrieved PHRs that improve system usability were then coded and similar features and functions were categorised under themes.

	Inclusion criteria	Exclusion Criteria
Item 1	Original research papers with full text accessibility.	Papers with PHR in the designed phase only.
Item 2	Papers must be written in English.	Papers not presenting the functionalities.
Item 3	Papers focused on studies that present technologies that allow patients to access systems such as PHRs or patient portals.	Sample in study were non-users or caregivers.
Item 4	Sample in the study include patients who used the system.	Papers that presented other systems ex. mHealth.
Item 5	Articles present the functionality or features of the PHRs.	
Item 6	Articles present the adoption, acceptance, engagement, and usability of the PHRs.	

Table 1. Inclusion & Exclusion criteria

Results

Characteristics of the selected studies

Numerous studies showed how PHRs were adopted or how consumer preferences affected PHR system usage. However, there is limited evidence to the usefulness and functionality of patient portals or PHRs. This paper aims to investigate the significant features and functions that may influence the acceptability of patient portals or PHRs and to examine how the features can improve the system's usability. The 19 articles (Table 2 and Table 4) included in this review employed a variety of methodologies, including observation, clinical trials, surveys/questionnaires, focus groups, semantic interviews, and cross-sectional data analysis. Furthermore, each study was qualitatively analysed to extract functions and features of personal health record systems. Each paper presented different function's types of patient portal (or PHR) using a variety of methods and display these functionalities depending on the perspective of the patient or the availability of these functions in the system.

Functions and features of patient portal & PHRs

We categorised the functions of PHRs in 8 themes (personal information management, communication, medication, laboratory, appointment management, self-monitoring, education & advanced function). Further, under each theme there are diverse types of functions and features of PHRs with their definitions, as presented in (Table 3).

Features' themes

Personal information management theme

The usage of PHRs increases patients' access to personal information, insurance information, and patients' clinical data. Patients can obtain their personal summary as well as their family's clinical history while using PHRs. The patient portal made it possible for customers to access their and their family record history in a useful manner. According to Ant Ozok et al. (2014), patients can access their history records & family history records which encourages patients to become more aware and knowledgeable about their health care which provided in PHRs systems. This helped the consumers, due to their family history, become more knowledgeable about health hazards. Furthermore, the majority of review articles revealed that patients frequently access the system to see or modify medical records. For instance, there was a higher likelihood of adding health information to the patient portal for individuals who used it three to five times (Swoboda et al. 2021). In addition, Son & Nahm's investigation in (2019) revealed the preferred system features of 194 participants and more than 35% of the total participants said that their favourite aspect of the system was access to their medical records.

Communication theme

The ability to communicate becomes a crucial requirement that PHRs consumers recommend and use. This could significantly impact communication between patients and their health care providers. Some of the features that were utilised particularly frequently were participants sending messages to their physician. These features were supported by 56.1% according to (Cross et al. 2021), 36.1% (Son & Nahm 2019), 88.9% (Kelly et al. 2016) of the total participants. Moreover, instead of the secure messaging feature, the chat and email features were also popular features in the patient portal. According to Nazi (2010), using the communication option enabled patients who use the "My HealtheVet portal" to have more educational talks with their doctors. Additionally, according to Ant Ozok et al.'s study, 10 patients reported that "My safe Tinet" made it easy for them to remember extra questions they had from their records for their doctors and quickly email them (Ant Ozok et al. 2014). Participants in focus groups for the studies by Hägglund & Scandurra (2022), and Portz et al. (2019), observed that PAEHR & My Health Manager systems enable them to work more collaboratively and openly with their healthcare providers by utilising email and chat features, sometimes without the need to physically visit the clinic.

Medication management theme

By giving a complete view of a patient's medication and medical information, PHR enables safe and responsible medication management. This could include the medications ordered, provided, and administered to the patient; any abnormal drug responses; any specific needs, like swallowing problems or cognitive impairment; and the due dates on the prescriptions. The medication prescription function in PHRs could lower prescription errors and prevent harmful drug interactions, thus ensuring patient safety. This will achieve fostering communication among all parties involved in patient care, ensuring medication continuity, and making prescribing and dispensing simpler and more effective through system. As presented in most studies, refilling prescriptions was the most used function of PHRs, preferred by 48.8% of participants in (Arcury et al. 2017), 36.1% of patients usually renewed prescriptions via the system in (Son & Nahm 2019), 41.0% requested medication refills in (Swoboda et al. 2021). Additionally, according to Nazi (2010), about 24% of consumers who used the "My HealtheVet" portal reported that they could renew their prescriptions by medicine name and have access to their medication history via the portal. Furthermore, it was noted in Vreugdenhil et al. (2019) and Portz et al. (2019) that patients can check their prescription list and history through PHRs.

Laboratory management theme

This theme offers practical management and presentation of laboratory data, including test requests and results. Accessing laboratory results feature are becoming a more popular and useful component of PHR systems. This is possible because the patients can examine their lab results, earlier tests, and compare. For example, patients viewing test/laboratory results in PHR systems generally view features according to Cross et al. study 72.6% of patients, Masterson Creber et al. study 43% of patients, and Swoboda et al. study 83.6% of patients (Crosset al. 2021) (Masterson Creber et al. 2018) (Swoboda et al. 2021). Most participants felt being able to access their test results was a significant feature for them. In the Vreugdenhil et al. (2019) research, the majority of patients who signed into the portal examined their laboratory results 89.7% of the time. This has previously been shown to be a key function for most patients.

Appointment management theme

Patients can access their previous and upcoming appointments as well as schedule appointments using PHRs. Additional health services such as specialist consultations, sample collection, admissions to hospitals, medical treatments, and internet consultations can also be included in the types of appointments. Traditionally, patients who wanted to make an appointment had to call the clinic. This process took some time, and sometimes patients could not obtain their preferred appointment time. However, Swoboda et al.'s study in (2021) showed how innovative approach can make things simpler and faster through accessing appointment feature in patient portal. For instance, the site was used to book appointments by 20.5% of customers and 36.1% of participants overall (Swoboda et al. 2021). This illustrates that having a book appointment function in PHRs, could replace the previous function such as calling canter of clinic.

Self-monitoring theme

Patients can control their personal-health information through clinical records through self-monitoring functions in PHRs. Self-monitoring functions can be included in the record by giving patients control and involving them in their medical care (Masterson Creber et al. 2018). Participants in the "My Safe Tnet" portal, for instance, stated that they could improve patient safety and keep an increased focus on

their well-being with the help of the system through offering these individuals more control over their own medical data and by serving as a trustworthy source of preventative measures and health-related knowledge (Ant Ozok et al. 2014; Nazi 2010). Additionally, a PHR feature called "proxy access" enables family members to participate in patient records (Strudwick et al. 2020). A participant in focus groups study by Zarcadoolas et al. (2013) mentioned that the proxy access function in patient portal capability allowed family to benefit from remote access to test results, child immunisation data, and appointment reminders. This is because PHRs prioritise obtaining proxy access to their children's or parents' electronic records and receiving benefits.

Education theme

Educational materials may use materials from reputable websites, medical libraries, audio-visual resources, or official government data. The material may include suggestions for leading a healthy lifestyle, first aid knowledge, discharge instructions, the surgical process, advice on physical activity, or health-specific education such as advice on pregnancy, psychological wellness, or chronic disorders. In the Zarcadoolas et al. (2013) study, the majority of participants were asked how they looked for and found health-related information. The majority of them made use of online resources like WebMD and Google searches. Using PHR educational capabilities can address the issue of unreliable internet search information by providing information from reliable websites, medical libraries, multimedia materials, or official government data. Information is therefore reliable and accurate, enabling patients to understand additional information regarding their health. According to a 2018 article by Masterson Creber et al. 82% of patients who utilised PHRs accessed educational materials within the portal, which provided them with beneficial knowledge.

Advanced functions' theme

To promote patient acceptance and utilisation of PHRs, advanced features are offered alongside some of the primary services, such as drug perception and laboratory reports. For instance, Son & Nahm's (2019) study revealed that PHRs' primary purposes include serving as a reminder to consumers to exercise and eat healthier. It is helpful because it enables users to monitor their health history and identify potential health risks and also, it is simple to use and straightforward. Participants updated their profiles and read suggestions based on their revised profiles during the Gagnon et al. (2016) study interview. Additionally, in the past, patients could not obtain all medical letters that examined the entire patient situation, for example when they needed to visit and get recommendations from another health care professional. PHRs offer printouts of medical letters that can be given to other carers when they visit. The printout letter added an advanced function to the patient portal, which improved the usability of the system and its acceptability by consumers.

PHR adoption, engagement, and acceptance

In the reviewed studies, 6 papers presented adoption of PHRs, 5 examined engagement with the system and 2 investigated acceptance of the system as shown in (Table 4). All papers agreed that functions and features may impact adoption and engagement of consumers and with that the usability of patient portals or PHRs. Patient portals are particularly useful tools for encouraging consumers to engage in their healthcare. In regard to PHRs, there is a difference in patient engagement and acceptance rates. Patient engagement can be increased by offering features and functions that give users control over and interest in their health. By facilitating functions, it can lead to an improve in engagement and adoption rate regarding PHR systems among consumers. Considering consumer perceptions of a portal's features and experience might assist with system adoption. For instance, patients with different medical conditions may use the patient portal more frequently and become engaged due to appointment features, medication management features, and provider communication features (Swoboda et al. 2021). Through patient portals, consumers have the chance to participate in their healthcare and are encouraged to assume more responsibility. According to a study by Strudwick et al. (2020) a portal may offer access to data that could enhance knowledge of one's health concerns and raise awareness of the particulars of the condition. Also, giving patients personalised information and recommendations features is important in order to increase system adoption and acceptance. This will be through designing a user-friendly and useful system that gives patients thorough and comprehensive advice is crucial for high adoption and acceptability (Ant Ozok et al. 2014).

Looking from this perspective, system usability was presented in 9 reviewed articles as shown in Table 4. Five studies examined the usability of the PHR system based on think-aloud observations of consumers' or patients' comments about the system. In contrast, four presented the usability of PHRs without specifying which functions or features affect their usability. In articles presenting usability of some features and functions, PHR consumers reported usability of the system more likely since they

used more than one feature of the PHR. Some articles, however, provide usability only based on the general interviews and surveys, without specifying particular functions. For instance, articles by Ant Ozok et al. (2014) and Hägglund & Scandurra (2021) showed 7 functions of a PHR system. However, a paper by Ant Ozok et al. (2014) investigated users' opinions and the impact of the functions on the system's usability. A paper by Hägglund & Scandurra (2021) examined the usability of the system as a whole but did not reveal the extent to which these functions affect the usability of the system. Furthermore, in the Hägglund & Scandurra (2021) paper 78% of inpatients and 83% of outpatients indicated that the PHR's usability for medication reconciliation was acceptable. This result shows that system functionalities such as medication refill could impact and enhance PHRs' usability among patients. Additionally, if most patients are not utilizing all or most of the functions offered, it raises significant concerns regarding whether or not patients are utilizing patient portals to their maximum capacity to manage their health. An example of this can be found in the result of a multi-method descriptive study used in (Ant Ozok et al. 2014) about the My Safe Tinet system. Due to their system study, the total usefulness of the "My Safe Tinet" system for customers scored 5.50 out of 7, with the functions of recommendations scoring 5.36, education scoring 5.59, and communication with a doctor scoring 5.41. Furthermore, most patients who were questioned why they used a patient portal by Czaja et al. in (2014) gave responses citing various PHR functions as the rationale for their use. This included managing medication and learning about preventative medical exams (86%), scheduling visits, and receiving information about medical conditions (90%), and corresponding with doctors (82%).

No.	References	No.	References	No.	References
1	Ant Ozok et al. 2014	8	Hägglund & Scandurra 2022	15	Strudwick et al. 2020
2	Arcury et al. 2017	9	Kelly et al. 2016	16	Swoboda et al. 2021
3	Crockett & Carter-Templeton 2020	10	Mandhana et al., 2020	17	Van der Nat et al. 2022
4	Cross et al. 2021	11	Masterson Creber et al. 2018	18	Vreugdenhil et al. 2019
5	Czaja et al. 2014	12	Nazi, 2010	19	Zarcadoolas et al., 2013
6	Gagnon et al. 2016	13	Portz et al. 2019		
7	Hägglund & Scandurra 2021	14	Son & Nahm 2019		

Table 2. Summary of review papers.

Patients' usage patterns and perspectives on the usefulness of their patient portals may provide significant information regarding how they control their health requirements. Patient portals are characterized by the features they access most frequently. According to Swoboda et al.'s research from (2021), patients who used the system 10 or more times per year accessed all of its features, while those who used it three to five times per year only used some of its features, such as providing health information, scheduling appointments, participating in decision-making, communicating with doctors, applying for medication refills, and requesting corrections. Likewise, Arcury et al.'s (2017) study found that patients who use the portal multiple times per month, have a favourable perception of its usefulness. Furthermore, a patient portal's usefulness and relevancy to assisting patients manage their illnesses and healthcare is examined to determine whether patients approve the use of the portal. Due to the functionalities of PHRs that allow patients to control their health when they have a chronic disease, they are more likely to use system. The link between health conditions and patients with the use of system functionalities, enhancing portal usability and according to Vreugdenhil et al. (2019), patients who have a minimum of a single condition or a healthcare professional's trajectory are more likely to use the features of their personal health records.

Discussion

The current systematic review shows the functionalities and features of common PHRs. According to the review, systems have noteworthy features and functions that make patient portals and PHRs more acceptable to patients. For instance, some functions and features could enhance patients to use PHRs to make active decision such as ability patients to be part of their treatment care plan, ability to input or examine the vital signs and ability to indicate pain level functions. In the case of systems that allow patients to participate in managing their health, a study by Masterson Creber et al. (2018) concluded that patients will be more engaged, satisfied, and motivated because they will have healthier behaviours and better health results. Therefore, PHR provides opportunities for customers to use information about their health in the system to make active decisions. Additionally, the system's educational features are just as vital as patients' health information (Ant Ozok et al. 2014; Strudwick et al. 2020). This is because PHRs can improve patients' health by educating them about their health beside their own medical records, lab results, or the ability to read their medical histories. The system additionally can provide recommendations depending on their data and offers links to external resources. Instead of learning about their health from an unreliable website, patients can learn for themselves through system recommendations and links to external resources.

Features of the patient health record categories mentioned in the literature have varying numbers of citations, which could indicate the impacts of these features on patient portals or PHRs. For instance, the most frequently reported feature category is medication prescription, while the least frequently mentioned feature category is personal information management. According to the reviewed studies, patients who participated in the study with chronic diseases were more likely to use the patient portal. Because patients with chronic diseases need medication to control their medical condition, therefore, PHRs provide the most essential function in the system that is necessary for the patient to manage their medication, which was presented in most articles. In contrast, a personal medical history feature is one of PHR systems' features. Through this feature, patients can access for example their family history records. This helps consumers, due to their family history, increase their knowledge of health risks. However, not all reviewed articles took into consideration patients' personal medical history feature. It is critical to incorporate into patient portal systems to encourage patients to increase their awareness of and understanding of their health care. Furthermore, an authorised person can access a family member's medical records via the Proxy Access function. This function is particularly significant for parents to be a part of their kids' records and PHRs give them this chance. Based on Kelly et al. (2016), Zarcadoolas et al. (2013) family members benefit from remote access to test results, child vaccination information, and appointment reminders. Due to the patient portal's capabilities, this is possible. This is so that PHRs can prioritise acquiring benefits and getting proxy access to their parents' or children's records.

The systematic review showed that exploring functionality is vital to enhance PHR recognition, which enhances system efficiency. The analysis confirms that the functions of PHRs are beneficial to the usability of the system. In this way, defined functionalities can be influenced by consumer preferences that affect PHR system usage. In this investigation, it was discovered that ten research articles exclusively discussed PHR functions and features, while only nine studies discussed it in the context of system usability. In contrast, four articles presented PHRs usability as a system without identifying which functions affect usability, while five papers demonstrated how functionalities influence PHRs usability. According to the reviewed papers, the most common features affecting PHRs usability were presenting recommendations from doctors, physician-patient contact, examining health issues & diagnosis, and entering patients' lifestyle and health habits. It was also noted that improved system usability included obtaining appointment information, medication prescriptions, physician-patient communication and laboratory results based on users' views. Additionally, if most patients are not utilising all or most of the features provided, it raises fundamental questions about whether patients are making the most of patient portals and also determined whether patients approve the use of the patient portal. This is done by looking at the usefulness and relevance of the portal in helping patients manage their ailments and healthcare. Patients are more likely to use PHRs because of the capabilities that provide them with control over their health when they have a chronic illness. However, the usability of

	Inclusion criteria	Exclusion Criteria
Personal information management	Providing demographic information.	1, 12, 14, 16, 8, 10
	Providing a patient's personal medical history.	1
Communication	Checking the profile summary.	1
	Presenting Recommendations from physicians.	4, 3, 15, 6
	Physician-patient communication.	2, 4, 7, 8, 10, 11, 12, 5, 15, 14, 18, 13, 16
Medication Management	Drug prescriptions.	19, 17, 13, 2, 4, 12, 16, 15, 14 11, 7, 5, 6, 9, 18
Laboratory Management	Accessing laboratory results.	4, 19, 13, 11, 16, 2, 7, 8, 10, 5, 15, 6, 18
Appointment Management	Accessing appointment.	19, 16, 14, 2, 10, 13, 5, 15, 18, 12
Self-Health Monitoring	Entering patient's lifestyle and health habits.	1
	The Proxy Access.	8, 15, 9, 19
	Involved in decisions.	19, 16
	Examining health issues & diagnosis.	16, 2, 7, 13, 5 , 18, 19, 11
Education	Presenting Recommendations from system.	1
	Selecting the resources link.	1, 15
Advanced Functions	Printing a Letter for the Caregivers.	1, 18
	Requesting a referral.	1
	Viewing medical record data.	2
	Viewing immunizations.	11, 9, 13, 19
	System profile.	8, 13, 19

Table 3. Illustration of functions and features of PHRs themes.

 a full range of PHR features and functions were not included in the selective studies to explore the value of PHRs functionality and usability to PHR consumers. The majority of patients in reviewed papers who responded when asked why they used a patient portal cited various PHR features as justifications. The usability of PHR functions and features may be affected by several factors, according to research that examined PHR usability without identifying which functions affected it. For example, patients who access the patient portal often have access to system features such as providing health information, making appointments, and more, which improves their system usability. On the other hand, patient medical issues influence way they use system features, which PHRs enable them to utilise to manage their health, increasing portal usability.

Reviewed studies	Methods	Acceptance/Engagement/Usability	Features & functions used
1	Survey/ interview/ focus group	Acceptance/ Usability	Presenting Recommendations from physicians., presenting Recommendations from system, printing a Letter, added patient's lifestyle and health habits, Selecting the resources link & checking the profile summary, providing demographic information, Providing a patient's personal medical history & Family History.
2	Clinical trail	Acceptance/ Usability	Drug prescriptions, Physician-patient communication, accessing appointment, accessing laboratory results, examining health issues & diagnosis, Requesting a referral.
3	Survey	Adoption	Physician-patient communication.
4	Survey	Engagement	Drug prescriptions. Physician-patient communication, Accessing laboratory results. System profile, Presenting Recommendations from system, Presenting Recommendations from physicians.
5	Mixed methods approach	Usability	Drug prescriptions, Physician-patient communication., Accessing appointment, accessing laboratory results, examining health issues & diagnosis, Viewing medical record data.
6	Semantic interview	Adoption	Drug prescriptions, Accessing laboratory results.
7	Survey	Usability	Drug prescriptions, Physician-patient communication, accessing laboratory results, examining health issues & diagnosis, viewing medical record data., Presenting Recommendations from system, Presenting Recommendations from physicians.
8	Survey	Adoption	Physician-patient communication, accessing laboratory results, System profile, Proxy Access, Viewing immunizations.
9	Survey	Adoption	Drug prescriptions, Viewing medical record data, System profile, Proxy Access.
10	Survey	Usability	Physician-patient communication, accessing appointment, Accessing laboratory results.
11	Clinical trial	Engagement/Usability	Drug prescriptions, Physician-patient communication, examining health issues & diagnosis, Viewing medical record data, System profile.
12	Survey	Usability	Drug prescriptions, Physician-patient communication., Accessing appointment, Viewing medical record data.
13	Focus groups	Adoption	Drug prescriptions, Physician-patient communication, accessing appointment, accessing laboratory results., Examining health issues & diagnosis, viewing

			immunizations, Added patient's lifestyle and health habits.
14	Clinical trial	Adoption/Usability	Drug prescriptions, Physician-patient communication, accessing appointment, Viewing medical record data.
15	Focus groups	Engagement	Drug prescriptions, Physician-patient communication, accessing appointment, accessing laboratory results, viewing medical record data, Proxy Access, Presenting Recommendations from physicians, Presenting Recommendations from system, requesting a referral, Selecting the resources link, Checking the profile summary.
16	Survey	Engagement	Drug prescriptions, Physician-patient communication, accessing appointment, accessing laboratory results., Examining health issues & diagnosis, System profile. requesting a referral, printing a Letter, Involved in decisions.
17	Survey	Usability	Drug prescriptions.
18	Mixed methods approach	Engagement/ Usability	Drug prescriptions, Physician-patient communication, accessing appointment, accessing laboratory results, examining health issues & diagnosis, Printing a Letter.
19	Focus groups	Usability	Drug prescriptions, accessing appointment, accessing laboratory results, examining health issues & diagnosis, Proxy Access, Viewing immunizations

Table 4. Summary of adoption, engagement, acceptance, and usability

In this paper, some additional features were found to be added to PHR systems compared to the previous research (Win 2006). For example, presenting recommendations from the system, selecting the resources link, involved in decisions, presenting recommendations from physicians, printing a letter for caregivers, and accessing appointment and these were considered to be the most up to date functions. With these functions, the patient becomes more active in the system, thus increases systems' usability. Moreover, this paper examined how systems' features and functions affect consumers' use.

Conclusion

The adoption, usability, and functionality of the system influence patient portal adoption and PHR usability increases substantially when customers request and utilise functions. In this paper, the review objective was to investigate how the features can enhance the usability and acceptance of the system. In addition, it examined the major features and functions that may impact the acceptability of patient portals or PHRs. This review used Covidence and NVivo 12 to elaborate and examine the empirical articles, resulting in 19 articles which met inclusion criteria. As a result of the review, the features and functions can be categorised as communication, medicine, laboratory, appointment administration, self-monitoring, education, and advanced function's themes. Along with these features and functions, this review examined the adoption, engagement, and usability of some of these features and functions in PHRs. For instance, the medication refill function could impact patients specifically who had chronic disease usability of PHRs. It can be concluded that features and functions identified in this review can improve usability and use among consumers of PHRs. Future research should include empirical studies to conduct a comprehensive examination of the functions and features and their impact on users engagement, adoption, acceptance with PHR systems.

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