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The role of electronic medical records in facilitating patient-centered care: A systematic literature review

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Abstract: There has been a growing focus on improving patient-centeredness and advancing electronic medical records in recent years. Patient-centered care involves delivering healthcare tailored to the individual needs of patients. Therefore, electronic medical records are essential for enabling patient-centered treatment by providing healthcare practitioners with easy access to patients' information. The objective of this study is to systematically review research that has empirically assessed the impact of electronic medical records on promoting patient-centered care, specifically from the patients' perspective. The research methodology employed in this study is the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) protocol. The keywords used in the search included electronic medical record, patient-centered care, and patient satisfaction. A search was conducted across three electronic databases. The inclusion criteria encompassed publications from 2014 to 2023, full-text papers, open access articles in English that focused on the deployment of electronic medical records from the patients' perspective. Twenty-eight journals meeting these criteria were analyzed. The findings suggest that electronic medical records have a positive impact on promoting patient-centered care through improved information exchange between clinicians and patients. To further enhance patient-centered care services, it is necessary to customize electronic medical records according to the specific needs of each individual patient. The disparity in patient satisfaction rates between individuals who utilized electronic medical records and those who used paper-based records is not significant.

Keywords: *Electronic medical record, Patient perspective, Patient satisfaction, Patient-centered care.*

1. Introduction

There has been a recent focus on enhancing the patient-centeredness of the clinical encounter. Simultaneously, there has been extensive investigation on the utilization of electronic medical records (EMRs) in both hospital and non-hospital settings. Several physicians desired to include the electronic medical records system in a manner that does not hinder the emotional intensity of the contact between the doctor and the patient. Therefore, it is beneficial to explore effective and cohesive approaches to simultaneously implementing EMR and patient-centered treatment [1].

Patient-centered care prioritizes the organization of healthcare delivery based on the specific requirements of the patient and is often considered the preferable approach to patient care. There have been several definitions of the concept of patient centeredness. Patient-centered care involves adopting a holistic approach that takes into account the biological, psychological and social aspects of the patient. It also entails understanding the unique needs of each patient, distributing power and responsibility among all parties involved, considering the behavior of healthcare providers and the healing environment, promoting a strong therapeutic relationship, and acknowledging the personal biases of the physician [2-4].

A study demonstrated that patient-centered care is associated with favorable effects on healthcare staff outcomes, such as satisfaction and ability to deliver personalized care, as well as improvements in

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patients' psychological well-being [5]. Patient-centered care acknowledges the individuality of each patient and seeks to engage patients in the process of making choices about their own treatment, with the goal of enhancing the overall quality and efficacy of healthcare provision [6]. Implementing patient-centered care can increase patient involvement in self-care tasks, such as monitoring blood pressure and glucose levels [7].

Originally, EMRs were predominantly utilized for the digitalization of patient charts and documentation, substituting paper-based data with electronic formats to enhance accessibility and minimize manual inaccuracies [8]. In recent times, EMRs has evolved into more inclusive systems, incorporating functionalities like clinical decision support, electronic prescription, and interface with other healthcare systems. This integration enables the smooth exchange of patient data among various healthcare providers, resulting in enhanced care coordination and a more comprehensive approach to patient-centered care [9].

Electronic medical records are essential for enabling patient-centered treatment by giving healthcare practitioners convenient access to complete and current patient information. This encompasses the individual's medical background, present prescribed drugs, findings from laboratory tests, and strategies for therapy. The availability of this information enabled healthcare providers to make well-informed judgments and customize their care to meet the specific needs of each patient [10].

The implementation of Electronic Medical Records (EMRs) across all levels of healthcare offers significant potential benefits to the healthcare industry. The computer is regarded as an external entity in the clinical setting and has been noted to alter the structure of communication between the clinician and patient [2]. Multiple studies have demonstrated the adoption of electronic medical records and its effectiveness for healthcare professionals. Currently, there has been no comprehensive analysis of electronic medical records in terms of their role in delivering patient-centered care services from the perspective of the patients. Hence, the objective of this study is to conduct a comprehensive evaluation of empirical studies that have assessed the impact of electronic medical records on promoting patient-centered care, specifically from the viewpoint of patients. The authors want to address the following research questions:

Q1. What is the role of electronic medical records in patient-centered care?

Q2. What are the features of electronic medical records that can improved patient-centered care?

Q3. Are electronic medical records which focused on patient-centered care related to patient satisfaction?

2. Material and Methods

2.1. Eligibility Criteria

This review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta Analyses (PRISMA) guidelines for systematic reviews, as shown in Figure 1 [11]. Studies were selected based on the following criteria: i) the study was published in English language; ii) published in an open access and peer-reviewed journal; iii) studies published from 2014 until 2023; iv) studies that focused on electronic medical records and patient's perspectives or satisfaction; and v) studies that focused on additional features of electronic medical records and patient's perspective or satisfaction towards the implementation. The exclusion criteria were as follows: i) reviews, case studies, reports, book chapters, protocols, dissertations and poster presentations, ii) studies before 2014 and after 2023, iii) full-text articles were not accessible, iv) studies that didn't focus on patient's perspectives or satisfaction towards the implementation electronic medical records and v) studies that didn't focus on patient's perspectives or satisfaction towards the additional features of electronic medical records.

2.2. Information Sources and Search Strategy

A literature search was conducted across three electronic databases: Scopus, Pubmed and EmeraldInsight. The key search terms were as follows:

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Keyword 1: "electronic medical record*" OR "medical record system*" OR "EMR" OR "electronic health record*" OR "EHR" OR "computerized health record*" OR "CHR" OR "computerized medical record*" OR "CMR"

Keyword 2: "patient satisfaction*" OR "patient centered care" OR "patient-centered care" OR "person-centered care" OR "person centered care" OR "patient focused care" OR "patient experience*"Both keywords entered with boolean logic "AND".

2.3. Study Selection

Electronic searches initially produced 11,968 results across three databases. After filtering the years, document types, languages and full articles, 2300 articles were retained. By removing duplication, the articles were screened into 1935 articles. The results were then manually screened by the first author for relevance for this review based on the title and the abstracts resulting in 52 articles. All review inclusions were carefully checked and discussed by the two authors. Discrepancies in selection were resolved through discussion. The final results included 28 articles retained for the data extraction and quality assessment (see Figure 1 for the flow diagram showing the selection).

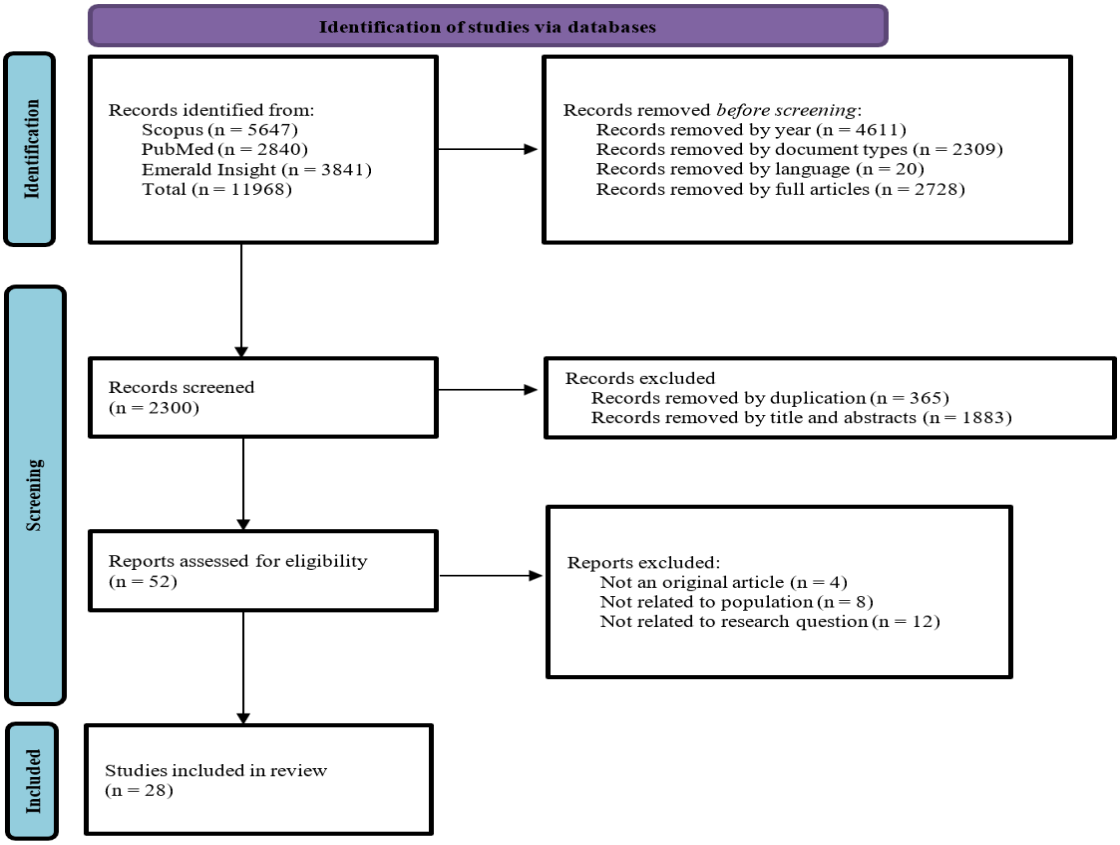

Figure 1.
Flow diagram of identification, screening, eligibility and included studies.

2.4. Quality Appraisal

The quality of selected studies was appraised using the Mixed Methods Appraisal Tool (MMAT) version 2018, selected for its validity, reliability and efficiency in assessing quantitative, qualitative and mixed methods studies. The MMAT is a checklist that includes two screening questions followed by five criteria that are specific to each of the study types [12]. The results were organized in Table 1.

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Table 1.
Quality appraisal of included studies.

Study type	Author/year	Screening 1: Clear research questions?	Screening 2: Data addresses research questions?	Criteria 1: Differs by study type*	Criteria 2: Differs by study type*	Criteria 3: Differs by study type*	Criteria 4: Differs by study type*	Criteria 5: Differs by study type*
Qualitative	Rose, et al. [13]	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Shah, et al. [14]	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Asan, et al. [15]	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Gerard, et al. [16]	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Valeur, et al. [17]	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quantitative randomized controlled trial	Patel, et al. [18]	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quantitative non-randomized	Brown, et al. [19]	Yes	Yes	Yes	Yes	Maybe	Maybe	Yes
	van der Vaart, et al. [20]	Yes	Yes	Yes	Yes	Yes	Maybe	Yes
	Ward, et al. [21]	Yes	Yes	Maybe	Yes	Maybe	Yes	Yes
	Winstanley, et al. [22]	Yes	Yes	Maybe	Yes	Yes	No	Yes
	Kantartjis, et al. [23]	Yes	Yes	Maybe	Yes	Yes	Maybe	Yes
	Moll, et al. [24]	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Meyerhoefer, et al. [25]	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Varadaraj, et al. [26]	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Bindschädler, et al. [27]	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	North, et al. [28]	Yes	Yes	Maybe	Yes	No	No	Yes
	Wali, et al. [29]	Yes	Yes	Yes	Yes	Yes	No	Yes
	Kaazan, et al. [30]	Yes	Yes	Maybe	Yes	Yes	Yes	Yes
	Liu, et al. [31]	Yes	Yes	Yes	Yes	Yes	No	Yes
	McKernan, et al. [32]	Yes	Yes	Yes	Yes	Yes	No	Yes
	Ibrahim, et al. [33]	Yes	Yes	Maybe	Yes	Yes	Maybe	Yes
	Meltzer, et al. [34]	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Huvila, et al. [35]	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Adomah-Afari, et al. [36]	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mixed methods	Lee, et al. [37]	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Helou, et al. [38]	Yes	Yes	Yes	Yes	Yes	No	Yes
	Zanaboni, et al. [39]	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Liu, et al. [40]	Yes	Yes	Yes	Yes	Yes	Yes	Yes

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2.5. Data Extraction

Table 2 provides the summary characteristics for selected studies. Data extraction included the study design, sample size, participant's age range, country, population, setting, intervention, comparison and outcome.

3. Results and Discussion

3.1. Characteristic and Quality of Included Studies

The studies included in the final review were published between 2014 and 2023. As seen on Figure 2, fourteen studies were conducted in The United States, two in Norway, two in Sweden, one in Australia, one in Netherlands, one in China, one in Japan, one in Malaysia, one in Ghana, one in Ireland, one in Saudi Arabia, one in Switzerland and one in United Kingdom. Most studies (n=19) were quantitative, five qualitative and four mixed methods. All studies met the screening criteria but only qualitative studies [13-17] met all MMAT methodological quality criteria [12]. Several quantitative studies lacked detail of samples' inclusion and exclusion criteria [21-23, 28, 30, 33] outcome data [19, 21, 28] and confounders analysis [19, 20, 22, 23, 28, 29, 31-33]. One mixed method study lacked detail of integrated results between qualitative and quantitative components [38]. Several studies didn't mention the age of the participants [14, 16, 19, 22-25, 28] several studies conducted in adults (n = 6) and both in adults and elderly (n = 14).

3.2. Research Topics

Included studies were concluded into four different themes, the implementation of electronic medical records (n = 12), personal accessible electronic medical records (n = 9), the additional features of electronic medical records (n = 6) and the comparation of different electronic medical records (n = 1). All studies examined patient satisfaction or patient's perspectives toward electronic medical records.

3.3. The Role of Electronic Medical Records

Twelve studies explained the role of electronic medical records. Studies Adomah-Afari, et al. [36]; Asan, et al. [15] and Lee, et al. [37] reported that electronic medical records viewed as a tool of communication and gives better understanding of the management plan and the health problem of the patients. Since electronic medical records documented in real time, there is no delay in providing the information and the results can quickly receive and waiting times decreased [13, 29, 37]. Studies reported sometimes, the health workers focused more on the computer than patients and they didn't let the patients to see their medical records [13, 15, 37] while some studies reported that health workers gave chances for patients to view their electronic medical records and adapting active listening attitude [29, 32, 34, 36, 38].

3.4. Additional Features of Electronic Medical Records

Fifteen studies reported the additional features of electronic medical records that could be beneficial. It consists of online access to electronic medical records [14, 17, 24, 27, 35, 39, 40] patient portals [20] CCCcare, an application for patients who had inflammation bowel syndrome to remind the treatment, visit appointment, psychological health and activity daily living [30] COVID-19 symptom checker [31] MyChart application to know patient's treatment in the hospital [22] laboratory information system to reduced waiting times and preanalytical errors [23] visit notes [16] and asthma care education program [18].

3.5. Patient Satisfaction

Patient satisfaction towards electronic medical records were varied between studies. Most of the studies reported satisfaction is higher in electronic medical records [13-17, 20, 22-24, 27, 29, 30, 32-40] and there were some studies reported no changes or unsatisfied with the implementation of electronic medical records [18, 19, 21, 25, 28, 31]. Studies reported the concern of the electronic medical records is

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hard medical terms [15, 17, 35, 39] complexity [20, 27] patient's privacy and security concerns [27] and lack of internet access [20].

4. Discussion

Electronic medical records (EMR) were developed in 1972 by the Regenstreif Institute in the Unites States. EMR became widely used in America after the American Recovery and Reinvestment Act (ARRA) was passed in 2009. Ophthalmologists in the United States have significantly increased their use of electronic medical records (EMR), nearly quadrupling from 19% in 2008 to 72% in 2016. EMR utilization is still at an early stage in India. The Indian government plans to implement a standardized system of Electronic Medical Records (EMR) [41]. In European countries, such as Sweden, Netherlands and Denmark more than half healthcare workers already used EMR. In Asia, many countries are transitioning to EMR technology, such as Malaysia, Korea, and China. In Africa, several regions had difficulties to implement EMR because there were barriers, such as high costs of procurement and maintenance system, lack of financial incentives, and poor electricity supply and internet connectivity [42].

Electronic medical record had been proven as a standardized format for documentation. EMR also ensuring convenient access and widespread distribution between doctors, patients and another healthcare workers. Electronic medical records possess the capacity to enhance the quality of healthcare (patient safety, effectiveness, efficiency, patient-centered, timely and equitable). Comprehensive patient data can enhance the efficiency and communication among healthcare professionals and patients. Thus, it could make healthcare providers to be more aware of patient's condition [29, 43].

Drug interaction is one of features that can improve the functionality of electronic medical records in facilitating patient-centered care [29]. Other than that, utilizing decision support elements, such as patient treatment notifications [26] clinical tracking using comprehensive monitoring along with compilation of information and templates that is specific to the illness [44] has been proven to improve the quality of healthcare, boost efficiency, and decrease the utilization of health services [45]. Studies showed that disease-specific record systems may be beneficial in other complex chronic diseases [30].

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Table 2.
Summary of included studies.

No	Author	Sample size	Age	Country	Population	Setting	Intervention	Comparison	Outcome
1	Shah, et al. [14]	26 Patients	N/A	UK	Patients who had accessed their health records at least twice in the last 12 months.	Manor House Surgery & Haughton Thornley Medical Centres	Giving access for patients' health records via PAERS (Patient Access to Electronic Records System)	N/A	Because they access their health records, patients thought they had made extra appointments. Patients reported they saved time and money for appointment. Electronic health records can also give them reminder about the contents of their consultation, including notes from their doctors, test results. By accessing their EHR, they can also prepare questions to ask. The downside is, sometimes there are technical issues so they can't be accessed or they want direct interaction.
2	Bindschädler, et al. [27]	150 patients	Adults and elderly	Switzerland	Patients who get treated in clinics.	Clinic for visceral and thoracic surgery of the cantonal hospital winterthur.	The implementation of oEMR (open acess EMR)	N/A	76% respondents supported oEMR. Pasien with basic and half-private health care were more likely to support an oEMR compared to full private insurance patients. Features desired by patients include a secure online portal (web-based not app-based), downloadable PDF files, and all information should be accessible. Patients who do not support oEMR due to privacy and security concerns, complexity and usability.
3	Brown, et al. [19]	1000 patients	N/A	USA	Patients who get treated in clinics.	7 Opioid Agonist Treatment Program (OATP) Clinics under Addiction Research and Treatment Corporation (ARTC)	The implementation of EMR	Pre vs Post EMR	There is no significant differences in patient satisfaction, length of stay and total complaints from patients.
4	van der Vaart, et al. [20]	373 pasien	20-86 years old	Netherlands	Patients diagnosed with RA	Arthritis Centre Twente di Enschede, The Netherlands	Patient get access (portals) to access their EMR	Pre vs Post Patient Portal	54% of patients use the portal and 40% say they have seen their EHR. Difficulties in its application are the lack of internet access, patient busyness, patient disinterest and ignorance of how to use it. Respondents with a good level of digital literacy (young patients, high level of education and internet use) had a better experience with the portal than respondents who did not. The portal is easy to use, although some patients find it difficult to access. Patients feel that by accessing the portal, patients feel more informed and involved in managing their disease.

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5	Kaazan, et al. [30]	310 patients.	< 25 years old - 75 years old	Australia	Patients with upcoming clinic appointments who diagnosed with IBD.	Royal adelaide hospital and Liverpool hospital.	The implementation of CCCcare.	IBD-data in generic medical records vs CCCcare.	Many participants agreed with the implementation of CCC-care. Several things that could be improved from CCCcare include adding information such as comorbidities, notes from the GP and technical issues such as the number of advertisements. The important point of CCCcare is that it helps remind you of treatment, visits to infusion centers, psychological health and ADL. Disease-specific record systems may be beneficial in other complex cronic diseases to augment quality of care and support clinical decisions.
6	Liu, et al. [31]	395 pasien.	18 - 60 years old	USA	All adults who responded to the Qualtrics feedback survey	University of California San Fransciso Health.	UCSF Covid-19 Symptom checker (integrated with EHR).	N/A	Almost half of the users reported that the tool improved their care experience. Most of the respondents said the tool helped them to get the care they needed. The most important feature adalah the ability to schedule their COVID-19 test online, 24/7 access to triage advice if they had COVID-19 symptoms or exposure. The tool was easy to use. The feedback provided includes the request changes to other services feature, additional functionality, appointment availability and request for more personalized health information.
7	North, et al. [28]	40.881.435 respondents.	N/A	USA	Patients who get treated in clinics.	Mayo Clinic Health System in Northwest Wisconsin, Southwest Wisconsin, Southwest Minnesota, Southeast Minnesota, Arizona and Florida.	Change from Cerner software to Epic EHR software.	Comparison of patient satisfaction upon EHR changes at each clinic.	The implementation of EHR changes resulted in patient visit scheduling being carried out in 2 systems which were considered ineffective by patients. Patient satisfaction dropped drastically where the patient perception of access component gave the largest decrease number, waiting times is higher than before.
8	McKernan, et al. [32]	201 pasien	Adults	Ireland	Patients who booked a visit for antenatal	Irish Maternity unit in Ireland	The implementation of EHR	Paper records vs Electronic records	The participants were positive about their experience with electronic records. They don't feel their consultation being altered by documenting it on computer system. Most of the patients want to have

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					care				online access to their charts. More education training in implementing EHRs should be taken.
9	Lee, et al. [37]	193 pasien	21-92 years old	USA	Patients who get treated in clinics.	Primary care clinic in University of Chicago	The clinic implemented the EMR system into ambulatory practice.	N/A	Most patients showed satisfaction with the use of EMR facilitated by specialist doctors. The EMR can be used as a tool to facilitate communication and promote better understanding of the management plan and the health problem they are experiencing. EMR is also documented in real time so there is no delay in providing information. It's just that, sometimes there are doctors who don't allow patients to see the EMR and some doctors focus more on looking at the computer than paying attention to the patient.
10	Ward, et al. [21]	34000 samples	Adults	USA	Patients who get treated in academic Emergency department.	24-bed, suburban, academic emergency department in Cincinnati Ohio	The implementation of EMR	PMR vs EMR	Patient satisfaction rates were decreased during the first 2 months after EMR implementation but gradually changed to baseline in the next 4 months.
11	Winstanley, et al. [22]	88 samples	N/A	USA	Inpatients who get treated in hospital.	St. Rita's Medical Center, Lima, Ohio	Implementasi MyChart bedside, an application that allows patients to view their EHR during an inpatient hospitalization.	N/A	Patients reported MyChart improved their communication with nurses, doctors and care team. They understand their medication better. Most useful features were laboratory results, medications, information about who was caring for them, seeing their schedule and learning more about why they were in the hospital. Most of them reports they used the tablet from hospital to access MyChart.
12	Wali, et al. [29]	377 patients	Adults	Saudi Arabia	Patients who get treated in clinics.	Bahra PHC, The Specialized Polyclinic, King Faisal Residential City Clinic in Jeddah, Sharia PHC in Makkah, King Khalid Residential City clinic in Taif.	The implementation of EMR	PMR vs EMR	There is an increase in patient satisfaction with the implementation of EMR compared to PMR. Aspects that have improved include: doctors pay more attention to patients during consultations because there is still time for doctors to explain the reasons for the examination and other health consultations. Doctors also apply an active listening attitude so that patients feel comfortable asking about their health condition. Patient waiting time is reduced. What needs to be improved is the drug prescribing process.
13	Zanaboni, et al. [39]	Quantitative = 1037 users. Qualitative = 268 users.	16 - > 65 years old	Norway	Patients who had activated their personal account and accessed their EHR	Online survey in Northern Norway and Western Norway by Norwegian Directorate of Health.	Implementation online access to EHRs.	N/A	Patients who accessed their health records online want to know their health information from their healthcare provider, preparing for next visit or sharing with their GP/families. They found it easy to access their EHRs online. Most of them wants to have more documents accessible through the service but with easier medical terms. With their online health records, patients felt

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					online.				better understanding of their health condition and easier to manage so they can prepare for their next visit. They said it became easier to communicate with their health professionals. The overall satisfaction was very high.
14	Adomah-Afari, et al. [36]	384 patients.	18 - >60 years old	Ghana	Patients who get treated in military hospitals that already implemented HER	37 military hospitals in Ghana	The implementation of EHR	N/A	The quality of care is the best in the areas of: attention to patients' needs, responsive health workers during emergencies, service efficiency, timeliness and overall service. Apart from that, communication between health workers and patients also shows very good figures. The existence of an EHR reduces waiting times and health workers pay more attention to patients. In addition, they can immediately find out the lab results. There is an improvement in the relationship between health workers and patients. EMR creates high patient satisfaction in the areas of service efficiency, speed of service and overall patient service.
15	Moll, et al. [24]	2587 samples	N/A	Sweden	Patients who had accessed the national electronic health record Journalen.	21 county concils in Sweden.	The implementation of EHR in Sweden (Journalen)	N/A	Patients with cancer, diabetes and other chronic conditions were the most frequest users. The most common reasons were gaining an overview, following up on visits and becoming more involved with their care. The most viewed feature is test results.
16	Meyerhoefer, et al. [25]	3900 patients	N/A	USA	Patients who get treated in clinics.	OB/GYN Practices in Lehigh Valley Health Network in eastern Pennsylvania	The implementation of EHR	N/A	Satisfactory rate in the early implementation of EHR is significantly decreased than before, but after 3 years the satisfactory rates return to normal.
17	Ibrahim, et al. [33]	321 patients.	Adults	Malaysia	Patients who received treatment.	14 public PHC in Seremban district.	The implementation of EMR	PMR vs EMR	General satisfaction and communication in EMRs were substantially higher than PMR.
18	Rose, et al. [13]	21 patients.	35-84 years old	USA	Patients who get treated in clinics.	Diabetes clinic at an urban medical center in Baltimor, Maryland.	The implementation of EMR	PMR vs EMR	Patients felt that when implementing EMR, patients had less eye contact with doctors because doctors focused on working on EMR. Things are different with nurses because nurses work on the EMR and explain what they write. Patients feel that with EMR, coordination between doctors and other health workers is well established so that there are no repeated questions. Patients feel that the lab results are received more quickly so that the doctor can immediately explain

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									the results. Patients feel that with EHRs, drug names will be spell checked so that there are no drug prescribing errors.
19	Helou, et al. [38]	Qualitative = 35 samples. Quantitative = 413 samples.	20-44 years old	Japan	Qualitative = Patient who had antenatal care visits and were in 8 - 33 weeks pregnancy. Quantitative = Pregnant woman who already done 3 antenatal care visits.	Qualitative = Antenatal care clinic at a Japanese university hospital. Quantitative = Japanese survey research company.	The implementation of EMR	N/A	Respondents explained that doctors use computer monitors that display the EMR and explain it, only that computer use limits face-to-face communication with patients. The use of EMR has not been integrated with other health systems, so that when patients visit other doctors, patients bring a paper copy of their medical record. Patients cannot yet access the EMR online, so patients have to record the complaints they feel at home and explain it in the next visit, so the doctor only provides conclusions about what is explained in the EMR, so there is no complete data (only a summary). Most patients only want to view the EMR online but do not want to add information to the online EMR.
20	Meltzer, et al. [34]	452 pasien.	18 - > 75 years old	USA	Patients who get treated in clinics.	Family medicine and Internal medicine primary care practices at the Mayo Clinic in Scottsdale Arizona.	The implementation of EHR	N/A	The patient reported that the health worker positioned the monitor so that the patient could also see his EHR and explain what was written. Patients also report there is sufficient eye contact and the doctor adopts an active listening attitude. Almost all patients explained that the implementation of the EHR had a positive impact on consultations.
21	Valeur, et al. [17]	40 patients.	21-84 years old.	Norway	Patients who get treated in clinics.	Internal Medicine Department in Northern Norway Regional Health authority.	Implementation of PAEHR, Pasientjournal.	N/A	Patients feel that the information provided by doctors face to face is sufficient and patients feel that the medical resume they take home provides good information. The medical terms used in PAEHR are hard to understand. Patients also feel that by reading a lot of information related to their health condition, patients feel more worried and overthinking.
22	Liu, et al. [40]	Qualitative = 79 samples. Quantitative = 235 respondents.	18 - 68 years old	China	Patients who want to access their EHRs in an application and caregivers who are authorized by patients.	Yuebei People Hospital	The hospital initiated a program called EHRs Openness, which provided inpatients with access to all sections of EHRs, including physician's notes, radiology results, operative reports and	N/A	The advantages of PAEHR are information that is up to date compared to paper based, information from doctors that can be viewed repeatedly and increased patient satisfaction because PAEHR meets patient needs. However, the information provided through PAEHR sometimes uses complicated medical language, there is too much information and the design and layout are not user friendly. Apart from that, there are limitations in using PAEHR, such as busy patients sometimes wanting to ask the doctor directly, not wanting to just go through RME, the smartphone used to access does not have internet. However, there are some patients who doubt the security of their data. Patients who use

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							billing information.		PAEHR are based on their attitude of wanting to use it which can be influenced by the environment, ease of use of the application and increased efficiency in accessing information.
23	Varadaraj, et al. [26]	100 samples.	Adults and elderly	USA	Patients using topical glaucoma medications and presenting to the glaucoma clinic	Glaucoma Clinic of the Johns Hopkins Wilmer Eye Institue	Web-based application of medication reminders integrated with EHRs patient portal	N/A	Most of the patients found the reminders to be useful and want to continue to use it. While it might be less beneficial to patients who already compliant or had their own reminder strategies, it was valued as an useful tool to patients in the weekend and while travelling, because they tend to forget. Patients also give feedback for improvement, such as separate reminder times for weekdays and weekends, voice call reminder or voicemails if the call was not being taken and reminders working in different time zones.
24	Asan, et al. [15]	32 patients	26 - > 65 years old	USA	Patients who get treated in clinics	Medical College of Wisconsin Primary Care Clinics.	The implementation of EHR	N/A	Patients felt that EHRs is being useful to record patient's history, give doctors ready access to patient's data, help both doctors and patients to remember patient's history and see how the patient's health is progressing. The negative side is sometimes doctors are more focused in their computer and the patients can't see the screen and full of medical terms. Some patients reported they felt engaged with their doctors.
25	Kantartjis, et al. [23]	Specimen collection Pre implementation: 704 patients, post implementation: 600 patients. Patient satisfaction pre implementation: 504 patients, post implementation: 417 patients.	N/A	USA	Inpatient and outpatients who get phlebotomy and serviced using EHR.	Tertiary care center in Boston Massacussetts.	Implementation of new laboratory information system (LIS) by SunQuest and electronic health record (EHRs) by Epic Systems	Pre vs Post Implementation EHR-LIS	Total service times from waiting time to finishing phlebotomy session before implementation is 15-20 minutes, while after implementation it get reduced into 10-15 minutes. The total number for preanalytical errors reduced from 3.20 per 1000 specimens to 1.93 per 1000 specimens. Perubahan yang paling drastis yang berpengaruh terhadap patient satisfaction adalah length of wait, from 72% to 93%.
26	Gerard, et al. [16]	260 patients.	N/A	USA	Patients registered with portal access and engaged with OpenNotes.	Primary care practices piloting OpenNotes project.	The hospital piloted an online OpenNotes patient reporting tool, visit notes that can be accessed from	N/A	Patients feel helped because visit notes help them to remember next steps. Lab results that appear in EHRs are also explained in the visit notes so that patients feel they are handled quickly. With visit notes, patients feel more able to collaborate in treating their illness with the doctor. By reading the visit notes, patients can better explain the complaints they are experiencing and

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							patient portal.		the questions they want to ask at the next consultation.
27	Patel, et al. [18]	Providers: 18 respondents, Patients: 116 patients.	Adults and elderly	USA	Providers and their adult patients with asthma in Southeast Michigan.	Ambulatory care practices in Southeast Michigan.	Implementation of Electronic Health Record - Physician Asthma Care Education (EHR-PACE) program	EHR-PACE vs EHR	There is no significant differences in asthma control, asthma-related quality of life, patient satisfaction and patient's perception of their healthcare practitioner's general communication practices between EHR-PACE and standard EHR.
28	Huvila, et al. [35]	1155 patients.	18 - > 67 years old	Sweden	Patients who have accessed the national PAEHR (patient accessible EHR), Journallen in Sweden.	Online survey of Journallen.	Implementation of PAEHR.	Group of age: Young Adults vs Older adults vs Elderly.	Respondents are satisfied with reading medical records online because they can get an overview of one's own health, recapitulate a visit. They felt better informed so if something wasn't clear, they could ask again. Young adults prefer to read medical records online for general interest, but older adults and the elderly like to know an overview of personal medical history and treatment, prepare for a visit. Young adults find it difficult to access medical terms, but elderly people find it difficult to access them.

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Patient portal might be one of solutions to build patient's involvement. Some studies showed by accessing their personal information through patient portal which enables patient to look for their medical record online, patient might feel secure and open with partnership between them and healthcare providers [43]. Accessing patients' medical records online gave them more time to read their notes from their doctor and informed their families or relatives about their health concern. This could give patients and their caregivers to fully aware and had a good coordination with healthcare workers regarding the treatment of their condition [14, 39].

Post-implementation, there has been a concern regarding patient satisfaction with electronic medical records. Study showed that patient satisfaction rate of the implementation of electronic medical record is higher than paper-based medical record. Enhancement of the clinician-patient rapport in general, as well as the decrease in waiting time, may be contributing factors [29]. While there were studies showed that the satisfaction rate was the same or decrease, it could be because electronic medical records had medical terms that was not easy to understand [39], complex to use [27] and lack of internet access [26].

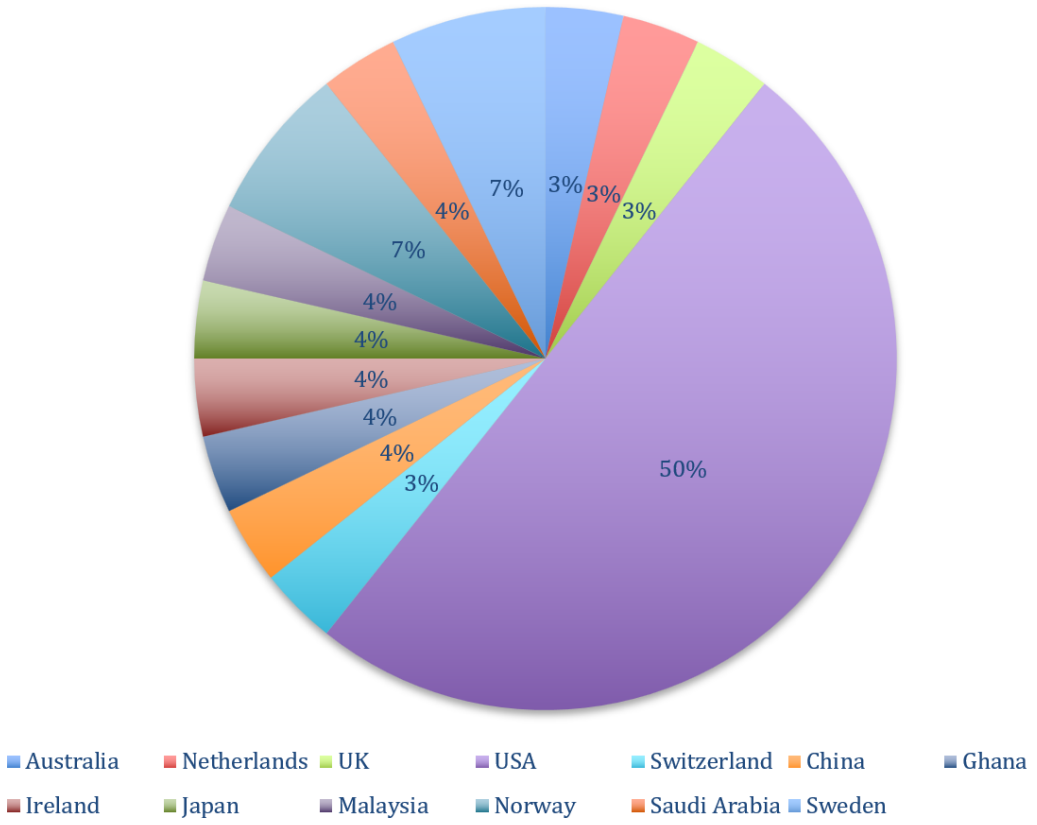

Figure 2.
Country of included studies.

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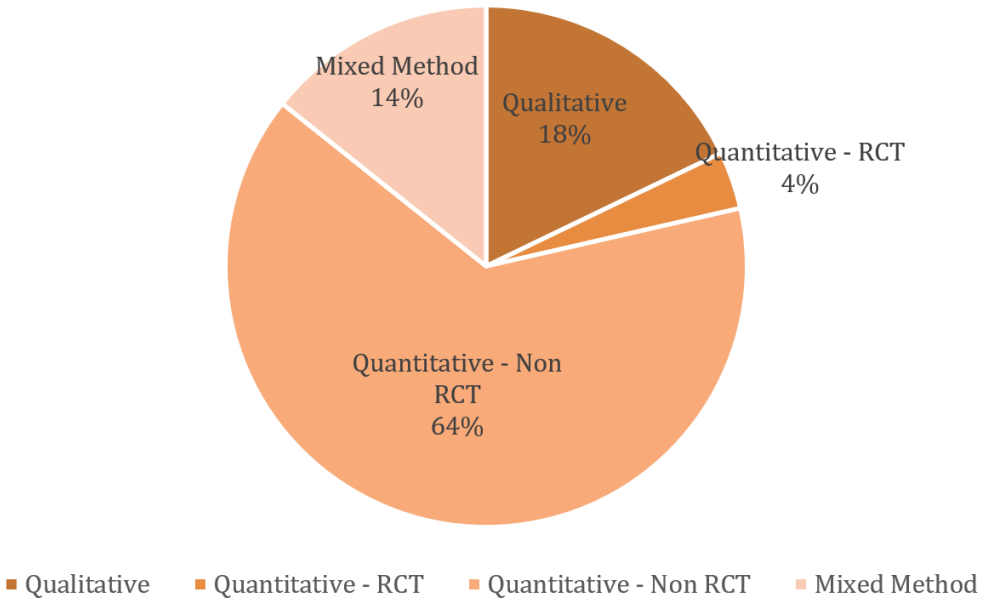

Figure 3.
Methodological design study.

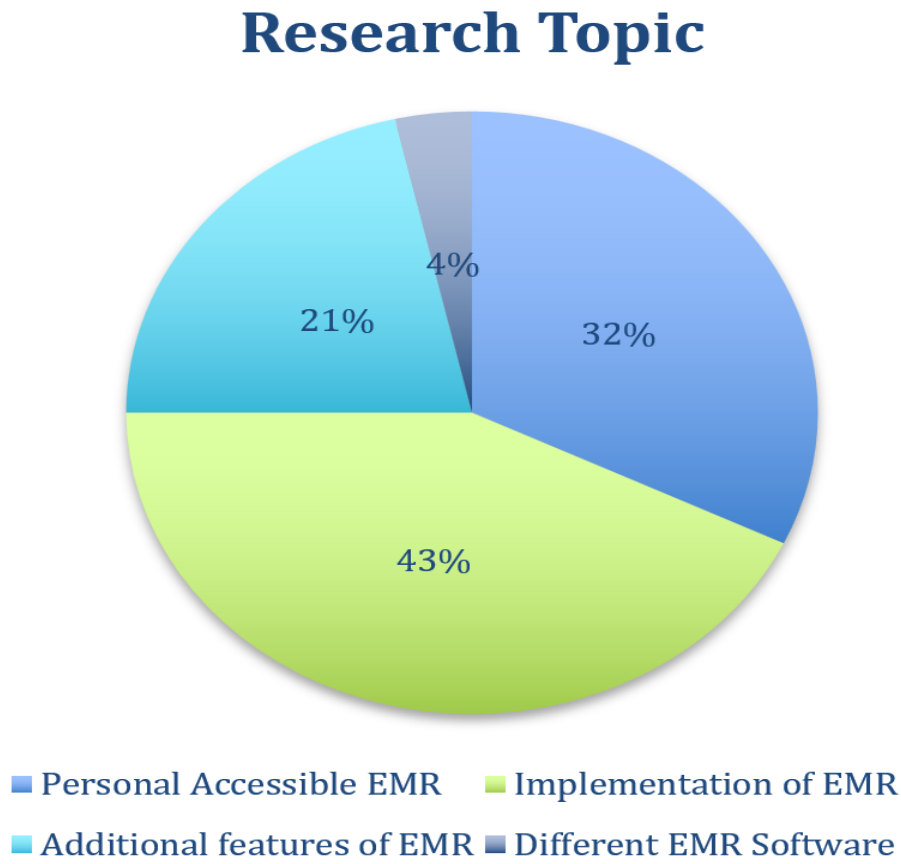

Figure 4.
Research topics of included studies.

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5. Conclusion

Electronic medical records play an important role in facilitating patient-centered care. For healthcare providers, electronic medical records can provide patient's up-to-date and comprehensive information, allowing for more informed decision-making and personalized care to the individuals' needs. Electronic medical records can also promote patient's involvement in their care decisions because patients reported the time and quality of shared knowledge between physician and patients is improved. To increase patient-centered care services, electronic medical record must be tailored based on every patient's needs. The implementation of electronic medical records can improve personalized patient care to increase the medical outcome of the patient.

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

Copyright:

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