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Technology adoption of electronic medical records in developing economies: A systematic review on physicians' perspective

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Abstract

Electronic Medical Records (EMRs) are a tool that could potentially improve the outcomes of patient care by providing physicians with access to up-to-date and accurate vital patient information. Despite this potential, EMR adoption in developing economies has been dilatory. This systematic review aims to synthesize the related literature on the adoption of EMRs in developing economies, with a focus on the perspective of physicians. With the aim to discern the key factors that impact EMR adoption as perceived by physicians and to offer guidance for future research on filling any gaps identified in the existing literature, this study utilized a systematic literature review by following the PRISMA guidelines. Out of 1160 initial articles, 21 were selected for analysis after eliminating duplicates and non-qualifying articles. Results show that common enablers of EMR adoption from physicians' perspective were identified to be computer literacy, education, voluntariness, and the system functionality including its features and user interface, implying that the provision of proper interventions focusing on the aspects of the health information system has an impact in maximizing the utilization and capabilities of EMRs among healthcare providers. The most prevalent barriers include the lack of training and IT usage experience along with resistance to changes associated with respondents' age and gender, the lack of time for learning complex EMR systems, and costs of the new technology. This indicates that a thorough planning and proper budget allocation is necessary prior to implementing and integrating EMR systems in healthcare institutions. From this synthesis of the common research conclusions, limitations, and recommendations from physicians' perspective, the result of this systematic review is expected to shed light on the optimal technology adoption of EMRs and its contribution to the health care systems of developing economies.

Keywords

Electronic health record, electronic medical record, technology adoption, technology acceptance, developing economies, physician perspective

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Introduction

Data gathering is a crucial step in directing and guiding healthcare providers (HCPs) toward caring of their patients. The process involves interviews about patients' medical and surgical history, treatments, pertinent physical examination assessment, diagnostics, and other services provided. These data are then transcribed into medical records to allow providers to track their patients' health condition, making a medical record, a valuable source of patient information.[1,2] In most developing economies, medical records are kept in paper files which are manually maintained and stored in filing cabinets. This system has the advantage of

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security as access without due authorization is highly improbable. Furthermore, this system allows for easy location and access for healthcare personnel.[3,4] On the other hand, paper medical records can be unsustainable, highly inefficient, time-consuming, and space-occupying. Due to the transcription of records on paper, updates need to be done manually without ways of backup, and storage and retrieval of charts may be arduous, making them prone to damage and loss.[4–6] These drawbacks led to their transition to electronic records. The idea of electronic records was introduced in the 1960s and has been continuously developed and endowed with numerous anticipated benefits, including improving the performance and quality of HCPs, improving the legibility of clinical notes, reducing human errors, providing easier access to medical information, diminishing duplication of efforts and documents, and optimizing the documentation of health data.[1,2,4,7] While the fundamental idea has remained the same, names and terms used to describe the concept of electronic records have changed frequently. A personal health record (PHR) is an individual's health record which could either be stand alone or may integrate health information from multiple sources; in which the patient whom the record belongs has the rights, manages, controls, and grants permissions for access by sharing with other parties.[8,9] An electronic health record (EHR), on the other hand, is a patient-centered longitudinal electronic record that is shared and/or interoperable across healthcare settings, while the electronic medical record (EMR) is a computerized medical record in a physician's office or clinic and is provider-centric, which are available to all with approved access on a designated network, but in most cases, the terms EMR and EHR are used interchangeably in health informatics.[7–10] Even though the transition to a paperless environment and the implementation of EMRs have many advantages, it appears to be very complicated. Various barriers may occur throughout the pre-implementation stage or even during the application of the primary stage, such as the lack of technological foundation, security and privacy concerns, restricted finance, the lack of technical competence and computer skills, the lack of infrastructure, the level of resistance to changes, and the level of priority for changes as the transition, which also entails the use of a new technology that calls for careful oversight and coordination of several factors including: selection of an EMR system, implementation, technical and procedural training, and maintenance.[1,3,11] This leads to a low usage rate of the system.

Technology adoption is the process of acquiring and incorporating new technology by an individual or an organization. While technology expands and is being adopted at a rapid rate in business sectors, Health Information Technology (HIT) in healthcare does not follow suit. The process of EMR technology involves multiple facets, such as stakeholders, perspectives of end users, vendors, organizations, and government, that may be contributory to the delay in its adoption.[12,13] End users of EMRs are primarily HCPs and staff who interact with the system daily to document patient care and access information. Vendors provide the EMR technology and support its implementation and maintenance. An organization, such as a hospital or clinic, must determine if EMR adoption aligns with its goals and budget, and make decisions regarding implementation, training, and workflow changes. Government agencies, such as regulatory bodies, play a role in setting standards and regulations for EMR usage and data privacy. Both vendors and healthcare organizations can accelerate physician acceptance and ultimately the rate of adoption and utilization of EMRs.[14] Healthcare organizations are experiencing difficulties in adopting and implementing EMR systems. In several European countries namely Sweden, the Netherlands, Denmark, Finland, and Austria, the percentage of general practitioners adopting EMRs is 90%, 88%, 62%, 56%, and 55%, respectively.[1] In Canada, about 50% of hospitals have partial levels of EMR implementation, and more efforts from the government are targeting EMR implementation.[15] In Malaysia, two hospitals are operating paperless and eleven hospitals are in Korea; a number of hospitals in China are adopting EMRs and similarly, hospitals in Asia are transitioning to EMR technology.[1] In sub-Saharan Africa, high costs of procurement and maintenance of the EHR system, the lack of financial incentives and priorities, poor electricity supply and internet connectivity, and primary users' limited computer skills, are the factors that hindered the widespread EMR adoption in some regions.[6,16,17] While EMR adoption has been successfully undertaken in different countries around the world, there are also many countries that lag.

There is an expected substantial difference between the rates of technology adoption between developed and developing economies. Developing economies are identified as the countries with less than $1046 GNI per capita and those between $1046 and $4095.[18] It appears that the developed economies are looking forward to changing all their systems to depend on the EMR/EHR as the only way of development.[4] However, in developing economies, the adoption of EMRs differs as there are several factors being considered, including the infrastructure of the healthcare system, the degree of education and training of HCPs, funding, and the cultural acceptance of EMRs. Hence, in many developing economies, the use of EMRs has not yet been fully implemented. There are a variety of factors identified, which are attributed to the low rate of EMR adoption as macro-level factors (e.g., the lack of national policy and the lack of informatics standards) and the micro-level factors (e.g., individual perceived complexity and resistance from physicians).[4,19–21] Customarily, physicians are known to be early adopters of new technologies. However, there seems to be a reluctance in the adoption and implementation of EMRs in their clinical practice.[21–23] Despite the potential to improve the quality of care, EMR

adoption rates among physicians working in both inpatient and outpatient settings remained relatively low, ranging between 5% and 30%.[21] It is therefore critical to comprehend the influencing aspects of physicians' intentions to adopt EMRs in developing economies. Nonetheless, there is a lack of research providing a comprehensive synthesis regarding the adoption of EMRs in developing economies from the physicians' perspective. The aim of this study is to provide a comprehensive narrative review of the relevant literature on physicians' adoption of EMRs in developing economies. The objective of this study is to synthesize the related literature on the technology adoption of EMRs and to identify the underlying factors that influence EMR adoption. Despite existing reviews on the technology adoption of EMRs, the novelty of this study is in the focus on the physicians' perspective instead of the perspective of entire organization. Moreover, much of the available studies of EMR adoption are conducted in already developed economies which have advancements in technology adoption. As a complimentary study as well as a supplement to existing studies on the already reported research and reviews on the adoption of EMRs, this novel work highlights the perspective of physicians in developing economies as a distinctive synthesis and analysis on the specialized context and contextualized challenges within the healthcare systems faced by healthcare practitioners in these geographical locations. This paper further aims to offer new perspectives and recommendations for future studies and is expected to provide the healthcare industry, physicians, EMR users, public health policymakers, health care decision makers, developers, EMR vendors, and IS researchers with valuable data and evidence to assist in the further development and refinement of EMRs in such regions.

Materials and methods

Literature profiling

This section details the methodology used in synthesizing the literature related to the technology adoption of EMRs, focusing on the physicians' perspective. By the end of this section, the authors will determine the sample size of the literature, profile the sample size, and identify the tools used in synthesizing the sample size, and will identify the gaps found in the each synthesized literature. This systematic review followed the 2020 Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) with a specialized structure to analyze the technology adoption and research gaps in the literature.[24,25] As shown in Figure 1, PRISMA illustrates the process flow of the study at each stage of the review. Additionally, the PRISMA flow diagram maps the number of records identified, included, and excluded, along with the reasons for exclusion. The authors gathered data from Google Scholar when acquiring articles for this review. To achieve the desired field of the relevant literature, several keywords were used, including "Physician," "Doctor," "Electronic Health Record," "EHR," "Electronic Medical Record," "EMR," "Acceptance," "Adoption," "Barrier," "Factor," "Developing countries," and "Implementation" in conjunction with Boolean operators (AND/OR) tailored to the search engine of the database.[3,21,26–28] The target articles should consist of at least one word from the keywords used. There was no limitation on publication date in the search; however, the earliest eligible article was published in 2007. Prior inclusion and exclusion criteria were applied to guide article selection. An article was included if it met all of the following criteria: it was published in English; the full-text of the article was available for review; it was an empirical study; it examined the perceptions of physicians toward the adoption or use of EMR prior to, during and after implementation; it reported factors influencing physicians' perceptions; reported factors connected to EHRs were included as the authors considered them to be a part of EMRs; and it was conducted in any developing country determined by the United Nations.[18] Review articles and case studies were excluded from this review.

The number of articles found using the initial search terms is 1160. For the article selection process, the authors screened the titles and keywords and identified 213 potential papers stored in Google Drive, serving as the authors' literature bank. After the initial screening, 173 articles were excluded as they did not meet the inclusion criteria and lacked significant contribution from reviewing the study context. 28 papers were rejected on context review, 13 did not examine physicians' perspective, 74 studies were conducted in developed economies, and 58 non-empirical research papers were excluded. The authors then reviewed the remaining papers, identifying that four papers were duplicates and they were subsequently removed. Out of the 36 papers, 15 were eliminated as the authors agreed that selected papers must be available in the Scopus or Web of Science (WoS) databases to maintain the credibility of the papers.17 are found in both Scopus and WoS, while four papers are only available in the WoS database; thus, 21 papers were selected for the final analysis.

After the final sample size was determined, the authors then profiled the 21 papers by using qualitative coding, in-depth analysis, categorization, and organization of the large amount of data into key themes and patterns.[29,30] This essential step allowed the authors to thoroughly review each literature by systematically synthesizing the information acquired from reading the abstract, followed by the conclusion, and then by using the backward technique to read through the results and discussions, methodology, and finally ending with the introduction. During this process, the authors identified potential themes and categories based on the data presented in each journal article. The identified themes and categories were then extracted and coded in a Google Sheet form through a tally matrix. The matrix included variables such as data collection

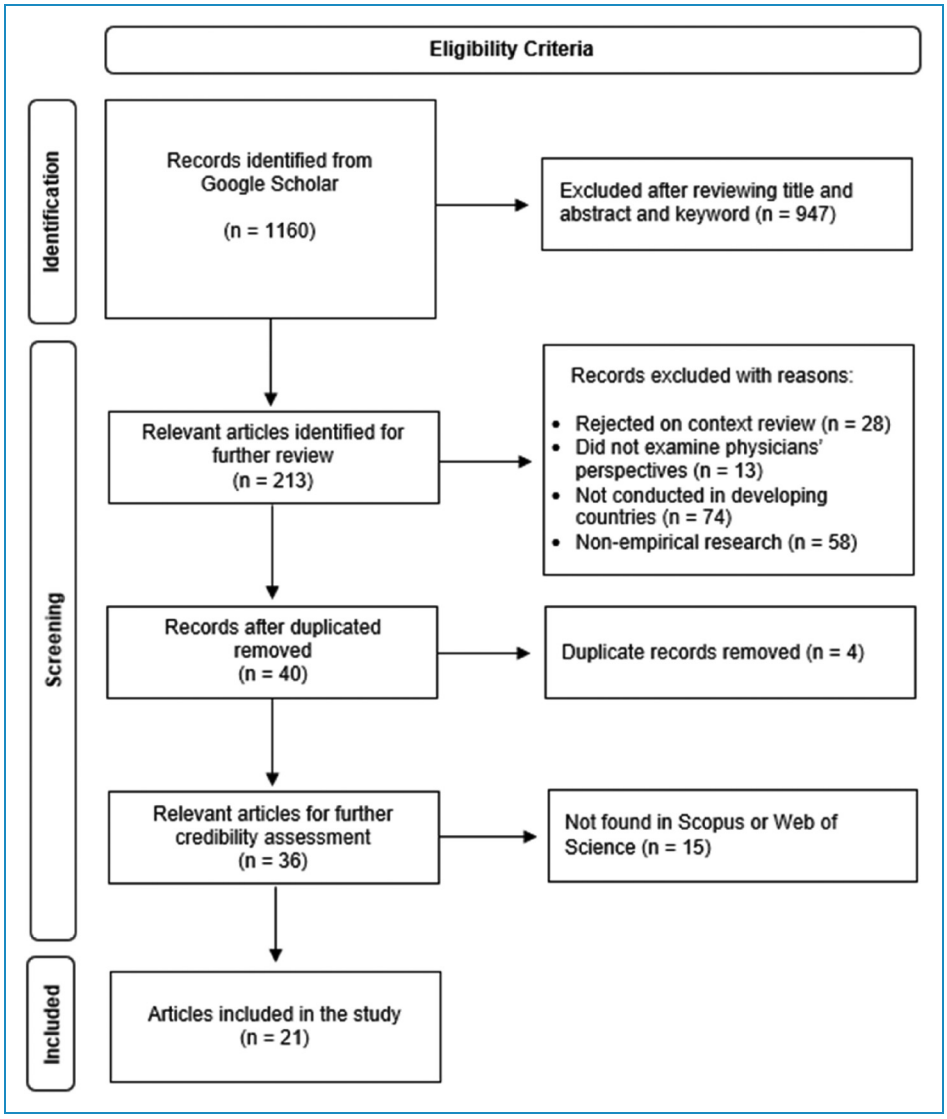

Figure 1. PRISMA flow diagram of the study selection process.

methods, country of data collection, year of publication, and the names of the authors.[27,31–33] Additionally, the authors also included the subject area and categories of the journals as a variable in the matrix. Assessing the subject area and categories can provide authors with a clear understanding of the level of exploration of the field. 21 literature studies were searched in SCI MAGO; the subject area, name of publication, and categories were then coded in the tally matrix.

Technology adoption analysis

This section details the strategy performed in data analysis to provide insights into physicians' behavior toward EMRs and the factors that influence the adoption of EMRs in developing countries. The purpose of this section is to discover the prevalent frameworks and to determine the factors that encourage physicians to adopt EMR systems or that hinder them from adopting EMR systems. After the profiling of 21 sample literature studies, the authors re-read the methods to tally the technology adoption framework used on another sheet in the tally matrix form. The authors used this variable to gain a deeper insight into the physicians' perspective in the literature. Another sheet was added as the authors conducted a thematic analysis approach in extracting the factors contributing to physicians' adoption of EMRs.[34] First, the authors manually extracted all enablers present in each literature, and then proceeded to extract the barriers after all drivers were coded. The identified factors are then mapped out using a Lucid chart diagram to illustrate the relationships between the factors that impact EMR adoption by physicians. The final themes/categories were defined clearly for further analysis and reporting of the results. As shown in Table 1 and Figure 2 the most frequently

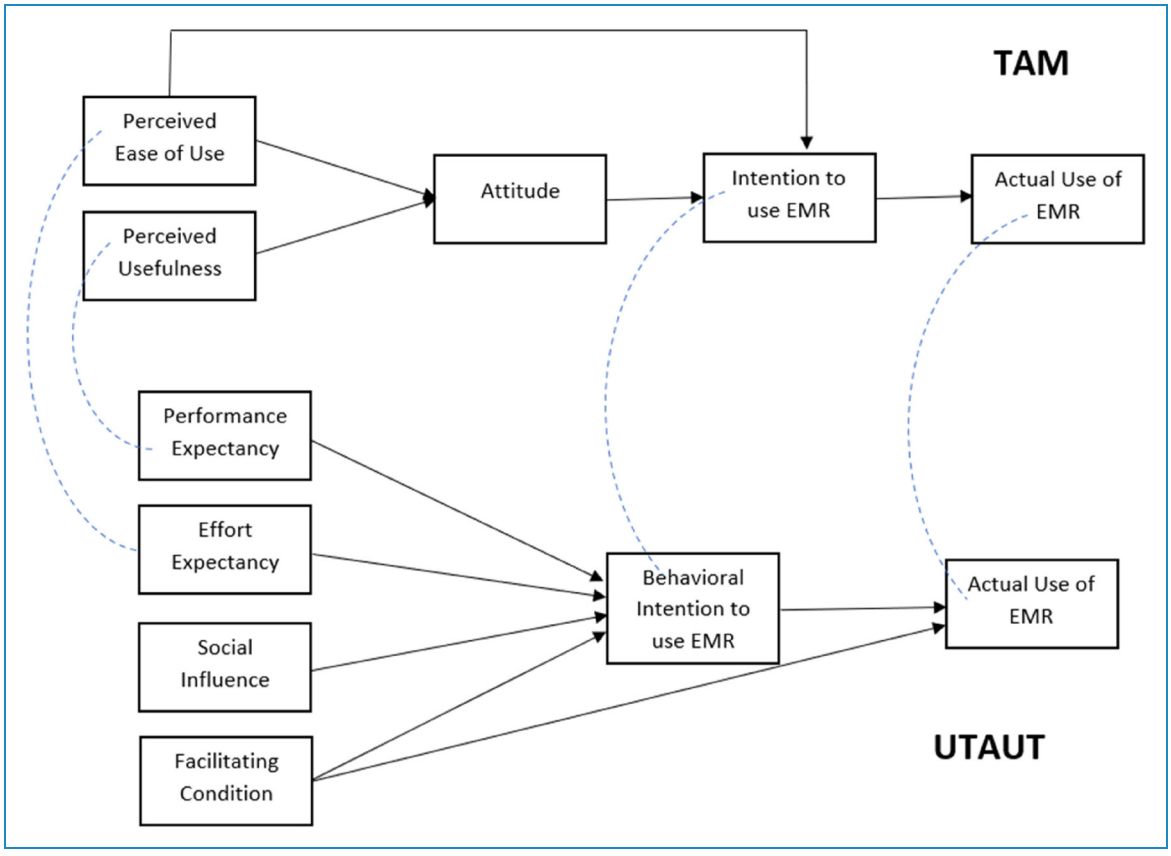

Figure 2. Comparison of the TAM and the UTAUT model in a previous study.[40]

Table 1. Commonly used frameworks from the sample size.

Theory name	2007–2009	2010–2012	2013–2015	2016–2018	2019–2021	Total
UTAUT		1[13]		1[35]	1[42]	3
UTAUT2					2[29,43]	2
TAM			2[36,37]		1[38]	3
TAM3					1[44]	1
Theory of planned behavior					1[45]	1
Technology continuance theory				1[39]		1
No theory	2[6,46]	1[47]	1[48]	1[49]	5[12,41,50–52]	10

used theoretical perspective of the sample literature studies is the Unified Theory of Acceptance and Use of Technology (UTAUT) with three papers and the Technology Acceptance Model (TAM) with three papers, followed by Unified Theory of Acceptance and Use of Technology Two (UTAUT2) with two papers. Other research utilized other different theories including the Technology Acceptance Model Three (TAM3), theory of planned behavior, and technology continuance theory with only one paper each, while the remaining ten studies make no clear reference to a theoretical foundation.

Research on end-user intention to use medical IT is ongoing, including studies that use single models like the TAM or UTAUT and studies that use a combined model

incorporating multiple existing[35–39] models. The UTAUT model can also be used to study end-user intention to use medical IT, incorporating theories of human behavior.[40] It is said that the UTAUT model can clarify as much as 70% of the variation in the intention.[41] It is widely used in various areas including the EMR system. The TAM proposed by Fred Davis is applicable in the healthcare setting and provides a solid basis for explaining users' intention to use the EMR system.[38] The TAM suggests that attitude, perceived usefulness, and perceived ease of use affect intention to use EMRs.[38] Consequently, a previous study outside the sample size used a model incorporating the TAM and UTAUT models.[40] The key variables in the UTAUT model include performance expectancy, effort expectancy, social influence, facilitating conditions, and intention to use. Performance expectancy (PE) pertains to the benefits that users perceive to receive from using the EMR system.[35–39] Effort expectancy (EE) refers to the ease of use perceived by the users, and the accompanying effort required to use the EMR system.[35–39] Social influence (SI) refers to the impact that others have on a user's adoption and use of the EMR system.[35,37,38] Facilitating conditions (FC) refer to the resources and support that are available for helping a user to adopt and use EMR systems.[35,37,38] Finally, Behavioral Intention (BI) to use refers to a user's overall intention to adopt and use EMR systems.[35] PE and EE in the UTAUT model are similar to the perceived usefulness and perceived ease of use variables in the TAM. Perceived Usefulness (PU) is defined as the degree of performance improvement that a person believes to achieve by using EMR systems, while Perceived Ease of Use (PEOU) is defined as the degree of effort that a person believes to use EMR systems. Attitude (ATT) on the other hand is defined as "the fun or pleasure derived from using EMR systems."[35,38] The UTAUT model was used as the basic framework to analyze the end-users' intention to use EMRs and integrated the concepts of the ATT of the TAM in the final analysis to analyze the physicians' intention to use the EMR.

In Figure 3, the model utilized in this study hypothesizes that, in addition to the four core components including PE (also known as PU in the TAM), EE (known as PEOU in the TAM), SI, and FC, attitude (ATT) toward using EMRs may have a major impact on the BI and actual use of EMR systems. The authors used this model to map out the factors that influence physicians' adoption toward EMRs. As used in this study, colored in blue are the core components of the model used, colored in green are the enablers while colored in red are the barriers of EMR adoption.

Research gap analysis

Research gap analysis is an essential step in identifying subject matters that need further study. This involves a thorough review of the sample literature and is crucial in ensuring the accuracy and reliability of results. In this section, the authors shall indicate the method used to analyze and

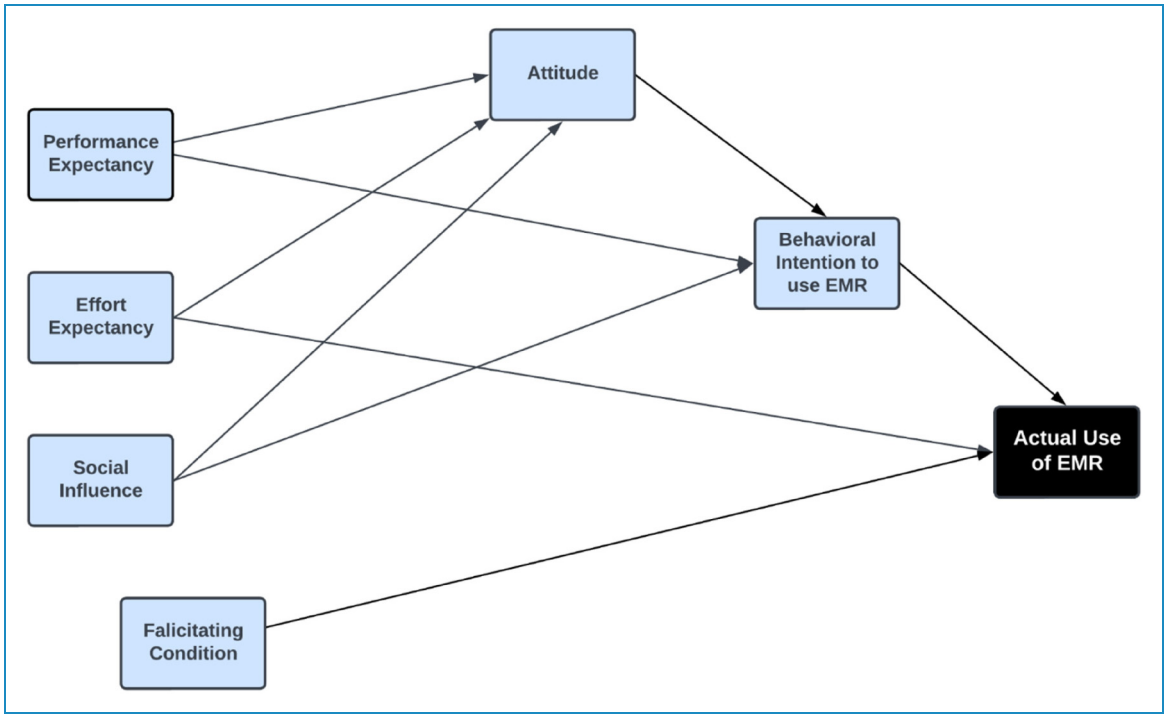

Figure 3. UTAUT model used in this study.[41]

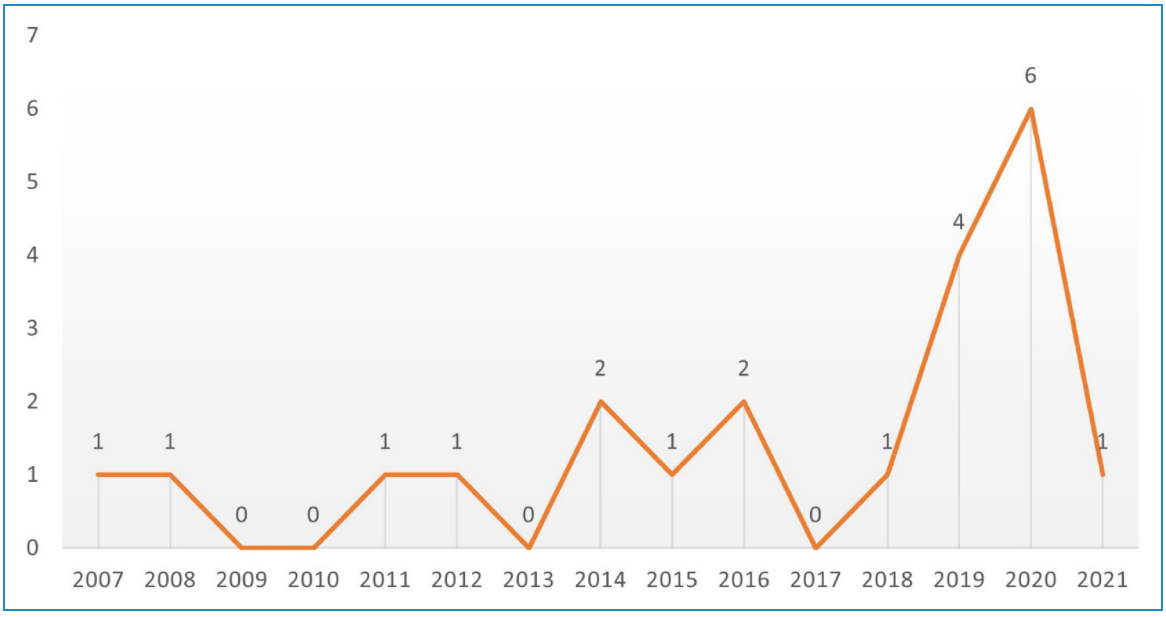

Figure 4. Publications per year.

synthesize the gathered data from the sample literature reviewed, and shall further draw conclusions and recommendations for future studies. The objective is to figure out which research has been completed and which areas still need attention. The authors went through each conclusion, limitations and recommendation section of the sample literature and recorded important variables using a tally sheet. The identified common conclusions and limitations were then listed using tabular categorization. A mind map diagram is a visual tool used to organize and structure information. When applied to the studies of physicians' EMR adoption in developing economies, mind mapping can provide a comprehensive overview of the recommendations put forth by experts in the field. By organizing these recommendations into a map, the interconnections and dependencies between the different ideas become more apparent, and prioritizing and implementing them become easier. This helps in creating a comprehensive understanding of the current state of the field and outlining a roadmap for future studies. The diagram includes a central node representing the main recommendation of the sample size and branches extending out from the central node that represent the subtopics or individual recommendation.

Results

Literature profiling results

The present study underwent a rigorous study selection process and only 21 studies were deemed eligible and included in the analysis. A majority of these 21 studies were published between the years of 2019 and 2021. However, the publication trend was found to be inconsistent, with fluctuations in the number of studies conducted over time. As illustrated in Figure 4, the earliest study identified in the sample literature dates to 2007, after which, only one study was done in 2008 and no further research was conducted until 2011. A gradual increase in the number of studies between 2012 and 2014 can be noted, however, with only less than four studies per year. Between 2018 and 2020, there is a significant increase in the number of studies, which could be attributed to the heightened interest in the implementation of EMRs in developing economies due to the COVID-19 pandemic. Table 2 presents a summary of the years in which the selected studies were conducted.

In Table 3, the result of the tally showed that the common method used to collect data based on the 21 samples were questionnaires with 15 studies.[6,12,29,35–39,41–44,48,50,52] The questionnaire was designed to gather information about the physicians' experiences and perspectives, and included a series of easily comprehensible questions with multiple-choice options to ensure accurate and consistent data collection. In addition to the questionnaire, six studies conducted interviews with the physicians to gather additional information and to gain a deeper understanding of the data collected.[12,13,38,47,49,51] The interviews were held in person and followed a structured conversational format, allowing the participants to freely express their thoughts and experiences. Two studies employed the observation method,[13,47] where the researcher observed the participants' behavior and interactions in a specific setting. Finally, two studies utilized the survey method,[45,46] which involved the administration of a series of questions aimed

Table 2. Year in which the selected studies were conducted.

Year	Number of studies	Reference	Year	Number of studies	Reference
2007	1	Ref.[46]	2016	2	Refs.[39,49]
2008	1	Ref.[6]	2018	1	Ref.[35]
2011	1	Ref.[47]	2019	4	Refs.[38,42,43,51]
2012	1	Ref.[13]	2020	6	Refs.[12,29,41,44,50,52]
2014	2	Refs.[36,48]			
2015	1	Ref.[37]	2021	1	Ref.[45]

Table 3. Data collection methods used in the sample literature.

Method of data collection	Number of studies	Reference
Questionnaire	15	Refs.[6,12,29,35–39,41–44,48,50,5212,13,38,47,49,51]
Interview	6	
Observation	2	Refs.[13,47]
Survey	2	Refs.[45,46]

at gathering information about a specific aspect of the physicians' experiences.

The analysis of the geographical distribution and research settings of the sample size is crucial in understanding existing data, as well as for its significance and advancements in the field. As depicted in Figure 5, Ethiopia has the highest number of studies conducted on EMR adoptions by physicians with five studies.[12,29,41,42,48] Moreover, Iran and Ghana had three studies on the subject matter, and Jordan had two studies, while India, Bangladesh, Turkey, Morocco, Kenya, and Egypt have one study, respectively. The studies conducted in these countries immensely contribute valuable data for understanding EMR adoption in developing economies and offer further insights into the challenges and opportunities faced by physicians in these regions. The trends in the studies conducted in these countries signify the need for further research on the adoption of EMRs in developing economies as the physicians perceived it to have a significant contribution in the management of patients.

The study analyzed 14 subject areas based on the Scimago classification (multidisciplinary, primary health care, environmental science, engineering, economics, econometrics and finance, immunology and microbiology, biochemistry, genetics and molecular biology, health professions, decision science, computer ccience, nursing, medicine, business, management, accounting, and social science). Figure 6 illustrates the distribution of studies across these subject areas. Medicine, computer science, and social science had the highest number of studies, emphasizing the importance of technology integration in the medical field. Business, management, and accounting, as well as nursing, had a notable presence. However, many areas, including primary health care, showed limited utilization of health information systems. This highlights the need to enhance health information systems' adoption, even in settings involving a large number of physicians.

The research also categorized the sample literature into various fields, as depicted in Figure 7. Health informatics emerged as a prominent area with ten sample literatures, reflecting the growing application of information technology in healthcare. Computer science applications had five sample literature studies, showing the integration of computer science in different sectors. Other categories, such as health policy, education, human factors and ergonomics, information systems, library and information sciences, and management information systems, all provide insights into the broad spectrum of topics and disciplines studied. The diverse range of categories, including nursing, biochemistry, genetics and molecular biology, economics, electrical and electronic engineering, and more, each with one sample literature study, underscores the interdisciplinary nature of the field. These findings provide a comprehensive overview of the areas of focus and topics explored.

Technology adoption analysis results

The acceptance and adoption of EMR systems depends on various factors, such as performance efficiency (PE), effort expectancy (EE), social influence (SI), facilitating conditions (FC), and attitude (ATT). Figure 8 maps these external adoption factors from 21 journals. The study indicates that

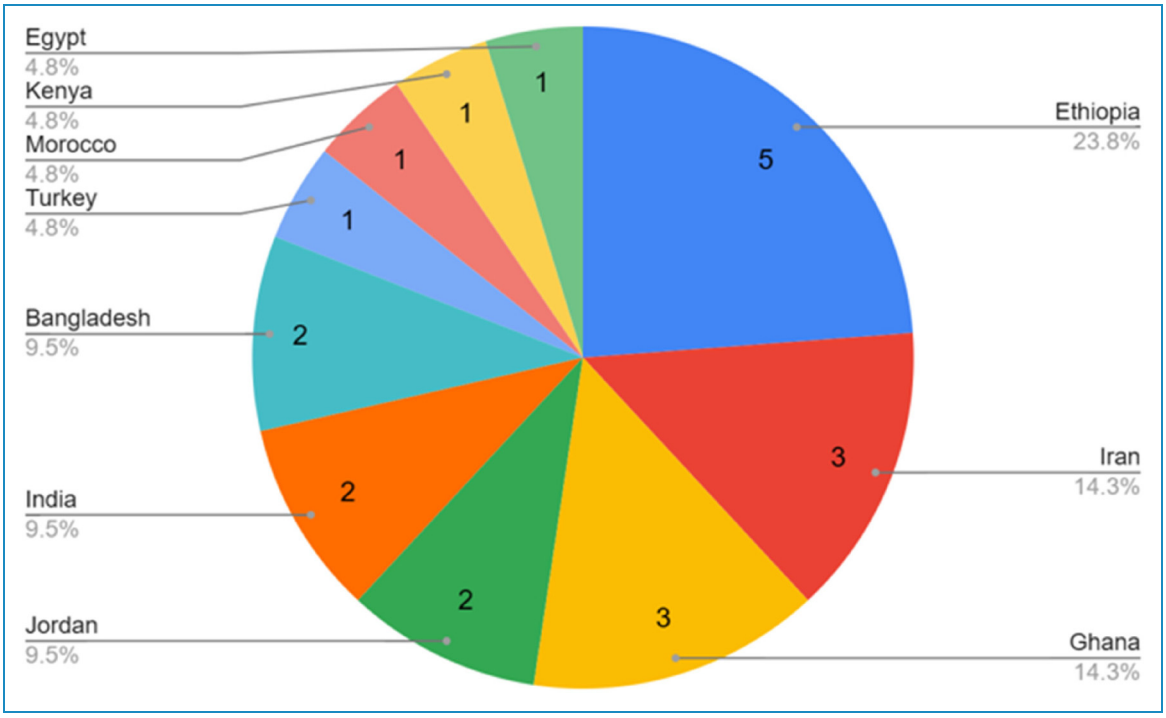

Figure 5. Geographical distribution of the sample size.

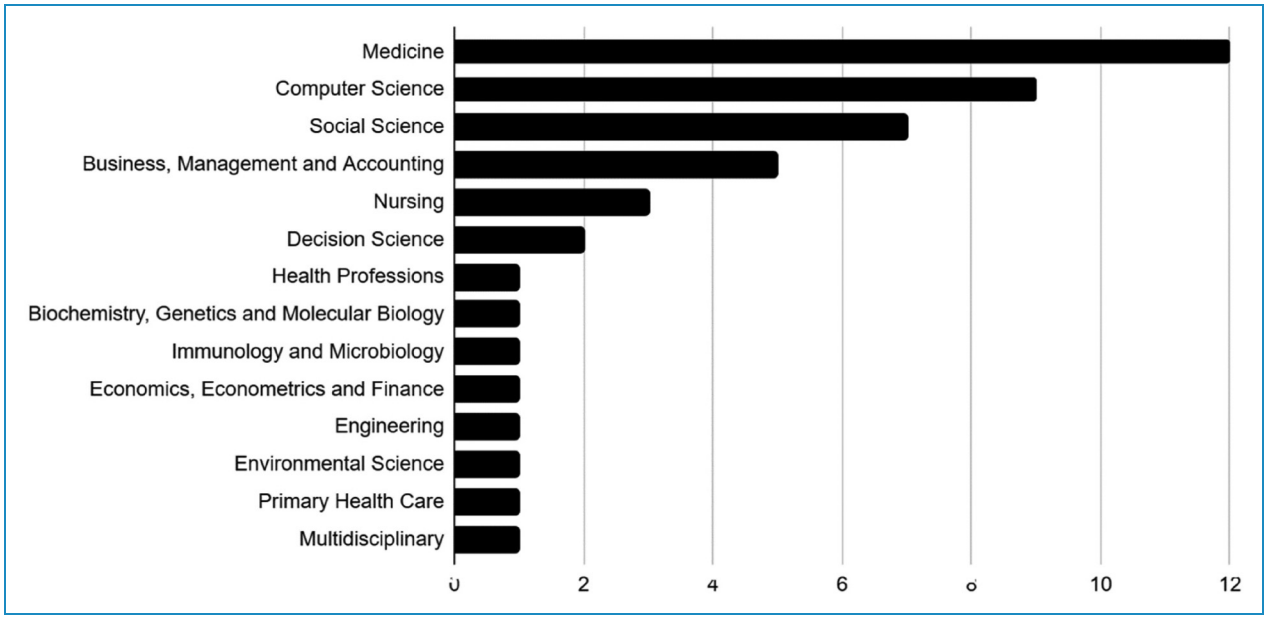

Figure 6. Subject area.

there are fewer identified enablers of EMR adoption compared to barriers in developing economies. This suggests that while enablers aim to facilitate the transition, many challenges and obstacles remain for physicians. Understanding these enablers is crucial for successful EMR implementation in developing economies. From 21 sample articles, eleven enablers were identified, including computer literacy, education, system features, voluntariness, system functionality, user interface, information quality, software mobility, ease of learning, policy, and computer self-efficacy. These findings are summarized in Table 4.

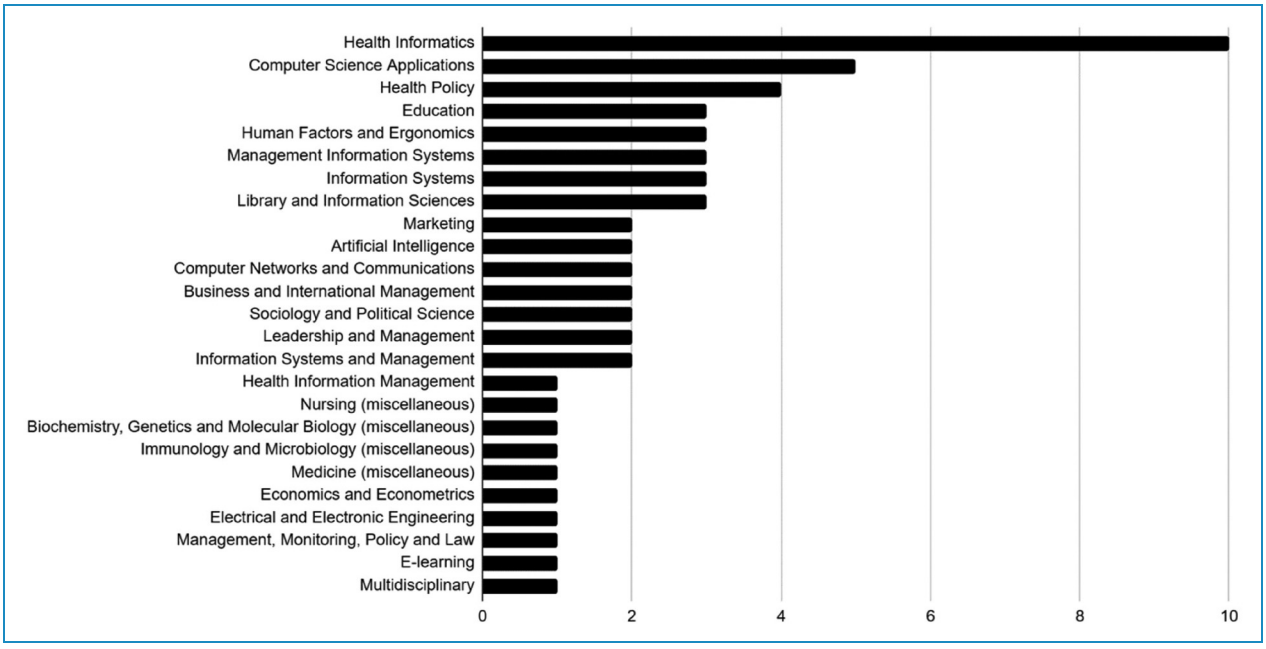

Figure 7. Categories of the journal.

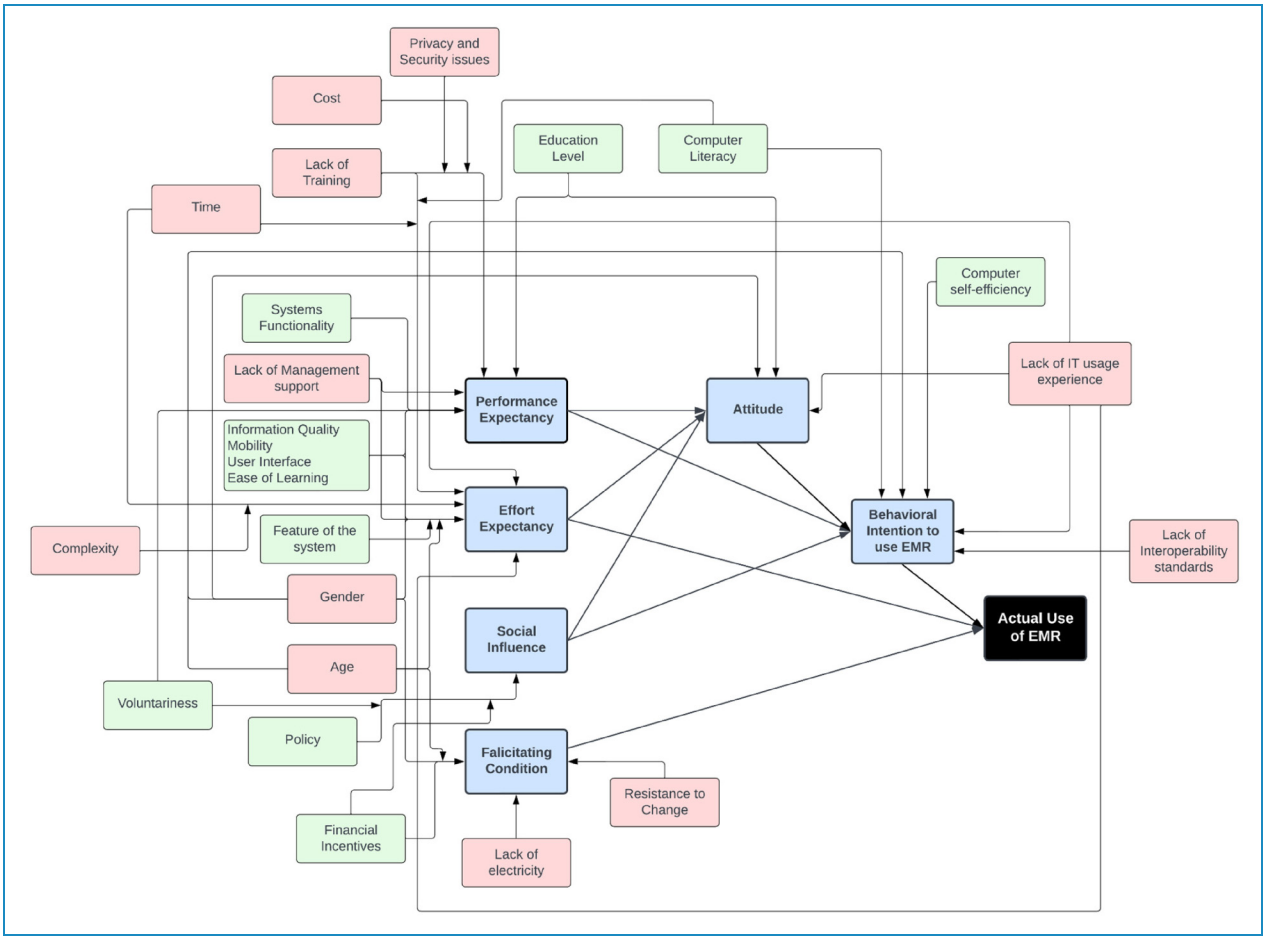

Figure 8. Mapping of the technology adoption factors.

Table 4. Enablers of EMR adoption in developing economies: physicians' perspective.

Enablers	Number of studies	References
Computer literacy	4	Refs.[12,42,48,52]
Education	3	Refs.[35,42,52]
Features of the system	2	Refs.[36,47]
Voluntariness	2	Refs.[35,44]
System functionality	2	Refs.[38,50]
User interface	2	Refs.[38,47]
Computer self-efficiency	1	Ref.[44]
Information quality	1	Ref.[38]
Software mobility	1	Ref.[38]
Ease of learning	1	Ref.[38]
Policy	1	Ref.[13]

Enablers of EMR adoption in developing economies. Understanding the enablers of EMR adoption from a physician's perspective is crucial for successful implementation. In this analysis, we focus on key factors driving physicians to adopt EMRs in developing economies. These factors significantly influence physicians' intention and attitude toward EMR adoption. From a review of 21 sample articles, we identified eleven common enablers. Computer literacy emerged as the most frequent, followed by education, system features, voluntariness, system functionality, user interface, information quality, software mobility, ease of learning, policy, and computer self-efficacy. We summarized these findings in Table 4 for reference.

Computer literacy and education. Different studies have emphasized the significance of computer literacy, which appeared in 20% of all occurrences (4/20).[12,42,48,52] It plays a crucial role in shaping physicians' attitude (ATT) and performance efficiency (PE) toward EMR adoption. In Northwest Ethiopia, health professionals with computer literacy were found to be 65.2% more prepared for EMR adoption.[48] Education, identified in 15% of occurrences,[35,42,52] is also influential. Comprehensive informatics education that equips healthcare professionals with the necessary ICT skills before entering the workforce is essential for the successful adoption and sustainability of EMR systems.[52]

System functionality. The functionality of the EMR system significantly impacts PE and EE.[38] This includes dose functionality, documentation functionality, and communication functionality. Dose functionality, which ensures accurate medication management, positively affects perceived usefulness.[38] Documentation functionality involves comprehensive and accurate patient data recording, while communication functionality facilitates interactions between healthcare providers and other stakeholders. Altogether, these functionalities streamline physician tasks and boost their confidence in EMR adoption.[50]

Enablers of PE and EE. Information quality, software mobility, user interface, ease of learning, and management support are other key factors influencing both PE and EE.[36,38] Information quality, which emphasizes the accuracy, completeness, and relevance of stored information, is of utmost importance, as it aids in informed decision-making and fosters trust in the EMR system. Software mobility enables EMRs to be used on various devices and locations, increasing intention and improving attitude. User interface's user-friendliness enhances system satisfaction. Computer self-efficacy, or a physician's belief in their ability to use technology effectively, has direct effects on EE and behavioral intention. Furthermore, usability and user testing are vital considerations in system design and functionality, impacting physician adoption.[53–56] Ease of learning, which simplifies system navigation and use, reduces frustration, and increases confidence. Management support is critical in motivating physicians to adopt EMRs. When management demonstrates commitment to EMRs, physicians see values in the technology and are more willing to integrate it into their work processes.

Policies and rules. The presence of rules and policies supporting EMR systems was reported in a previous study.[13] Policies emphasizing the importance of EMR systems in improving patient care foster positive social influence (SI) among physicians, leading to increased intention and positive attitude toward EMR adoption.[57–59] Mandates requiring the use of EMRs for all patient-related activities create responsibility and accountability among physicians, encouraging technology adoption. Policies that provide resources, such as training and support, enhance ease of use and the overall positive impact of EMRs on physician practices.

Barriers of EMR adoption in developing economies. The analysis of the articles in the systematic literature review revealed multiple barriers to adopting an EMR. Barriers that are linked to the same problem were grouped under a common term. The thirteen barriers that appeared 49 times were identified and are organized by the frequency of occurrences among the studies, with the most frequent listed first in Table 5. The barriers to adoption included lack of training, lack of IT usage experience, age, time, gender, cost, resistance to change, lack of management

Table 5. Barriers of EMR adoption in developing economies: physicians' perspective.

Barriers	Number of studies	References
Lack of training	9	Refs.[12,13,35,36,41,46,48–50]
Cost	6	Refs.[6,13,43,47,50,51]
Lack of IT usage experience	5	Refs.[35,39,44,47,48]
Age	5	Refs.[35,43,44,48,52]
Time	5	Refs.[35,36,41,41,44]
Gender	4	Refs.[35,43,48,52]
Resistance to change	4	Refs.[13,35,49,51]
Lack of management support	3	Refs.[36,41,49]
Privacy and security issues	3	Refs.[43,46,49]
Lack of electricity	3	Refs.[6,35,49]
Lack of interoperability standard	2	Refs.[49,51]
Complexity of the system	1	Ref.[48]

support, privacy and security issues, lack of electricity, lack of interoperability standard, and complexity of the system.

Training and education. The lack of training affects performance efficiency (PE) and effort expectancy (EE), a major barrier that appeared in 18% of total occurrences (9/50).[12,13,35,36,41,46,48–50] Many physicians have not received EMR system training, which can be attributed to the absence of access and planning for training (73.4%) and a lack of interest (9.2%).[41] Proper training is crucial for readiness, as physicians who underwent EMR training were 3.63 times more prepared.[12]

Cost and financial considerations. Cost is a significant barrier, appearing in 12% of occurrences.[6,13,43,47,50,51] Healthcare organizations and physicians find these costs challenging to justify, especially in the public sector. Concerns about return on investment (ROI) can deter investments in EMR systems.

IT usage experience and demographic factors. Physicians in developing economies often lack experience with technology, impacting PE, EE, and attitude. Age plays a role, with younger physicians more open to EMRs.[35,43,48,52] Gender influences PE, EE, facilitating conditions (FC), attitude (ATT), and behavioral intention (BI). Male physicians tend to be more favorable toward computer usage.[52]

Time constraints. Time is a crucial factor for physicians who manage multiple patients and tasks. The adoption of EMR systems can be perceived as time-consuming, affecting PE, EE, and ATT.

Resistance to change. Resistance to change is a challenge, especially among older physicians.[13,35,49,51] Previous negative experiences with technology can lead to distrust of innovation.

Management support. Lack of management support was identified as a barrier to adoption in four studies;[36,41,45,49] thus management support is essential for successful EMR implementation, impacting both PE and EE.[36] Physicians in organizations with higher management support are 2.59 times more likely to adopt EMR systems.[41]

Privacy and security issues. Privacy and security issues are barriers to PE and have been long-recognized issues in EMR adoption.[43,46,49]

Electrical power reliability. Unreliable electrical power is a significant hindrance, especially in rural and underdeveloped areas.[6,35] It affects the proper functioning of EMR systems and forces physicians to rely on paper-based systems.

Interoperability and system complexity. The lack of interoperability between system components and system complexity poses barriers to EMR adoption.[49,51] Interoperability issues lead to duplicate diagnostic tests, missed diagnoses, and other errors that can have significant consequences for patient health. Finally, the complexity of the system contributes to the reluctance of physicians to adopt EMRs.[53,54] A cross sectional study in Ethiopia identified complexity as one of the barriers.[48] EMRs are often designed with many advanced features and functions, which can be difficult for physicians to use. Additionally, the complexity of the system can further lead to user errors and result in increased workload for physicians.[53–55] Many EMR systems require a steep learning curve, with complicated menus and workflows that can be challenging to navigate, and extensive documentation, which can be time-consuming.[55,56] Learning a complex system can lead to burnout and decreased job satisfaction for physicians who may feel that administrative tasks are taking up valuable time which normally is spent on patient care.

Discussions

Common conclusion of the related literature

The analysis of the conclusions provides a clear picture of the importance of EMR systems in improving the quality of healthcare. In the field of EMR adoption, studies conducted in developing economies have reached several common conclusions listed in Table 6. Firstly, the readiness of physicians to adopt EMRs is heavily influenced by various factors such as age, experience, computer literacy, and organizational culture.[29,35,37–39,42,43,46,48,52] This highlights the importance of understanding the individual perspectives of physicians to facilitate a successful implementation of EMRs. Secondly, it has been determined that a participatory approach is crucial in ensuring the success of EMR implementation.[13,35,37–39,44,47,49,51] This means that healthcare providers should be involved in the design, development, and implementation of EMR systems to ensure that the systems meet their needs and workflows. Thirdly, EMR systems have been recommended for improving healthcare quality by reducing medical errors, improving patient safety, and promoting efficient and accurate data management.[29,35,37,38,46,49,50] Fourthly, the adoption and success of EMR systems require a combination of training, promotion, and readiness factors.[12,35,37,41,48,52] In summary, these research findings underscore the intricate dynamics of EMR adoption in developing economies, emphasizing the necessity of customized approaches that account for individual factors affecting physicians' readiness. Additionally, the significance of a participatory approach in system design and implementation, coupled with the potential of EMR systems to elevate healthcare quality through error reduction and enhanced data management, becomes evident through the collective insights of these studies.

In order to successfully integrate EMR systems into healthcare practices, a comprehensive strategy is crucial. This involves training healthcare providers in the effective use of these systems, promoting awareness of the benefits associated with EMRs, and ensuring that the necessary infrastructure and support are in place to facilitate a seamless implementation process. This multifaceted approach is essential for overcoming potential challenges and maximizing the positive impact of EMRs on healthcare delivery. Similar insights have been corroborated by studies conducted in developed economies, underscoring the universal importance of training healthcare providers as a vital intervention in the successful adoption of EMRs.[1,20] This convergence of findings highlights the significance of investing in the knowledge and skills of healthcare professionals to enhance their competence and confidence in utilizing EMR systems effectively. Furthermore, it is emphasized that the full potential of EMR systems in improving healthcare quality is yet to be fully realized.[13,37,47,49,52] While technological advancements have been substantial in recent years, there remains an ample room for improvement and further exploration of how EMRs can be optimally utilized in the unique contexts of developing economies. This recognition underscores the ongoing nature of innovation and the need for continuous efforts to harness the transformative capabilities of EMRs in enhancing healthcare practices, ultimately leading to improved patient outcomes and overall healthcare quality.

Table 6. Common conclusions of the related literature studies.

Common conclusions	Number of studies	Reference
Healthcare providers' readiness for EMR adoption is influenced by various factors	10	Refs.[29,35,37–39,42,43,46,48,52]
Successful implementation of EMR requires a participatory approach	9	Refs.[13,35,37–39,44,47,49,51]
EMR systems are recommended for improving healthcare quality	7	Refs.[29,35,37,38,46,49,50]
Adoption and success of EMR systems require training, promotion, and readiness factors	6	Refs.[12,35,37,41,48,52]
The full potential of EMR systems in improving healthcare quality is yet to be fulfilled	5	Refs.[13,37,47,49,52]

Common limitations of the related literatures

There are 21 limitations listed in the tally matrix shown in Table 5. The mentioned limitations of each study were summarized and categorized into four themes including the lack of generalizability and external validity, data availability and quality, study design and methodology, and bias and confounding variables. The primary issue observed in the current literature is scarcity of generalizability and external validity. The restricted demographics of the study sample and its confinement to a single hospital restrict the generalizability of the findings.[6,12,35,44–46,50,52] Furthermore, it is challenging to involve other hospitals, further limiting the external validity of the study. The results obtained from other countries may not accurately reflect the situation in developing nations. The second challenge noted in the literature is the availability and quality of data. This means

that prior studies have had limited scope, resulting in partial data loss, and hindering further analysis.[6,39,45,47,50] Additionally, the studies have typically focused on examining the impact of the most significant factors, rather than a comprehensive list of all possible influencing factors. This is due to the limitations posed by short-term data collection, cost and logistical constraints associated with traveling to the study setting. The third challenge identified in the literature is the presence of bias and confounding variables. This arises from the failure of previous studies to distinguish between physicians' specialties and their level of experience with EMR systems.[36,39,41,43,46] The reliance on self-reported data rather than actual usage data for EMRs has also contributed to a potential bias toward a group of "early adopter" physicians. The comprehensive analysis of the related literature has revealed common limitations, predominantly centered around issues of generalizability and external validity, data availability and quality, study design and methodology, and potential bias and confounding variables. Addressing these challenges is imperative for advancing the understanding of EMR adoption in developing economies and fostering more robust and inclusive research methodologies in the future. As the field progresses, efforts should be directed toward overcoming these limitations to enhance the reliability and applicability of findings, ensuring a more nuanced and comprehensive understanding of the factors influencing EMR adoption in diverse healthcare settings.

Practically in most developing economies which have already matured in the aspects of interoperable standards, one of the main advantages of a good EMR is that it can be further used as data sources for training and machine learning of most Artificial Intelligence (AI) tools in order to aid clinicians in making sound decisions. The literature has shown that for developing economies, advancements in making the EMR datasets usable for AI-assisted clinical decision support systems should also be strategically developed. Finally, as for the limitations in study design and methodology,[35–37,52] previous studies have relied on practitioners' self-assessment and adoption intentions rather than actual adoption, which can limit the accuracy of the results. Additionally, cross-sectional study designs may not accurately reflect actual usage patterns over time. The summary of the identified common limitations is shown in Table 7. In many developing economies that have successfully embraced interoperable standards, the effective implementation of Electronic Medical Records (EMRs) goes beyond simple record-keeping—it becomes a valuable resource for training and machine learning applications in Artificial Intelligence (AI) tools. The adoption of EMRs in these settings allows for the development of AI-assisted clinical decision support systems, ultimately aiding clinicians in making informed and sound decisions. However, the literature underscores the need for strategic advancements to harness the full potential of EMR datasets for AI applications, particularly in developing economies. Moreover, the identified common limitations in study design and methodology further emphasize the complexity of studying EMR adoption in these contexts.[35–37,52] A notable limitation lies in the reliance on practitioners' self-assessment and adoption intentions rather than actual adoption, potentially introducing biases that limit the accuracy of study results. Additionally, the use of cross-sectional study designs may not adequately capture the dynamic and evolving nature of EMR usage patterns over time. These limitations are summarized in Table 7, pointing toward the necessity of refining research approaches to ensure more robust and reliable insights into the adoption and utilization of EMRs in developing economies. Further elaboration and refinement of methodologies are crucial for overcoming these challenges and advancing our understanding of the intricate dynamics around EMR adoption in diverse healthcare settings.

Table 7. Common limitations of the sample literature studies.

Common limitations	Number of studies	Reference
Lack of generalizability and external validity	8	Refs.[6,12,35,44–46,50,52]
Data availability and quality	5	Refs.[6,39,45,47,50]
Study design and methodology	5	Refs.[36,39,41,43,46]
Bias and confounding variable	4	Refs.[35–37,52]

Common recommendations of the related literature

Table 8 provides a comprehensive overview of common recommendations derived from the sample literature, outlining key areas that warrant attention in future research on Electronic Medical Record (EMR) adoption. These recommendations aim to enhance the understanding and implementation of EMR systems, fostering advancements in healthcare technology adoption:

1. Longitudinal studies (4 studies). The call for longitudinal studies underscores the importance of tracking EMR adoption over time, allowing researchers to discern how user dynamics and relationships among variables evolve.[35,39,45,46] This approach offers a nuanced understanding of the temporal aspects of EMR utilization and contributes to a more accurate reflection of actual system usage.
2. More representative sample (4 studies). Diversifying the participant pool emerges as a crucial recommendation, advocating for the inclusion of professionals from

Table 8. Common recommendations of the sample literature studies.

Common recommendations	Number of studies	Reference
Longitudinal studies	4	Refs.[35,39,45,46]
More representative sample	4	Refs.[35,44,45,51]
Investigation of actual adoption	3	Refs.[35,45,46]
Mix of quantitative and qualitative methods	2	Refs.[35,41]
Comparison between public and private hospitals	2	Refs.[6,51]
Assessment of computer expertise	1	Ref.[52]

different hospitals with diverse backgrounds.[35,44,45,51] A more representative sample ensures that research findings are applicable to a broader audience, considering the varied contexts of healthcare settings.

3. Investigation of actual adoption (3 studies). Delving into the depth of actual adoption patterns, including the extent of usage, types of functions utilized, and user satisfaction, is highlighted as a key area of focus.[35,45,46] This recommendation emphasizes the need for a comprehensive exploration of EMR implementation beyond surface-level assessments.
4. Mix of quantitative and qualitative methods (2 studies). The suggestion to employ both quantitative and qualitative methods aims to provide a holistic understanding of critical factors influencing the success of EMR systems in healthcare.[35,41] This approach enables researchers to capture nuanced insights that quantitative data alone may not reveal.
5. Comparison between public and private hospitals (2 studies): Recognizing potential disparities in adoption rates and barriers, comparing experiences between public and private hospitals is recommended.[6,51] This comparative analysis offers valuable insights into the impact of organizational structures on EMR implementation strategies.
6. Assessment of computer expertise (1 study): The recommendation to assess the computer expertise of clinical care providers underscores the importance of evaluating the skills and abilities of healthcare professionals in using technology.[52] This objective assessment is deemed crucial for the successful implementation of EMR systems.

In summary, these common recommendations collectively guide future research endeavors, advocating for a comprehensive, nuanced, and contextually aware exploration of EMR adoption. By addressing these key areas, researchers can contribute valuable insights to the ongoing improvement of healthcare systems and technology adoption strategies.

The recommendations outlined in Figure 9 offer strategic insights into advancing research on EMR adoption, emphasizing nuanced approaches to address the intricacies of this evolving field:

1. Longitudinal studies. As shown in Figure 9, the call for longitudinal studies implies a sustained investigation into EMR adoption over time. This approach provides a comprehensive understanding of the evolving patterns, changes, and trends in the field. By tracking adoption trajectories, researchers can capture the dynamics and nuances inherent in the utilization of EMRs.
2. More representative sample. Acknowledging the need for a more representative sample, the recommendation urges researchers to consider a diverse range of medical specialties and account for variations between urban and rural settings, as well as private and public hospitals. This broader inclusivity ensures that research findings are applicable across different healthcare contexts, contributing to a more comprehensive understanding of EMR adoption.
3. Investigation of actual adoption. Focusing on the investigation of actual adoption, researchers are encouraged to delve into the frequency and types of EMR usage. This includes assessing user satisfaction and identifying existing barriers to adoption. By going beyond surface-level assessments, researchers can uncover deeper insights into the practical aspects of EMR implementation, fostering a more nuanced understanding.
4. Mix of quantitative and qualitative methods. The recommendation for a mix of quantitative and qualitative methods underscores the importance of employing diverse research approaches. Surveys, interviews, and case studies can collectively offer a comprehensive understanding of the multifaceted factors influencing EMR adoption. This methodological diversity ensures a richer exploration of the complexities inherent in healthcare technology adoption.
5. Comparison between public and private hospitals. Recognizing potential variations in adoption rates and barriers, the suggestion to compare experiences between public and private hospitals provides valuable insights into the impact of organizational structures on EMR implementation strategies. This comparative analysis contributes to a nuanced understanding of how different healthcare settings navigate the challenges of EMR adoption.
6. Assessment of computer literacy. Finally, the recommendation to assess the computer literacy of physicians emphasizes the importance of evaluating their

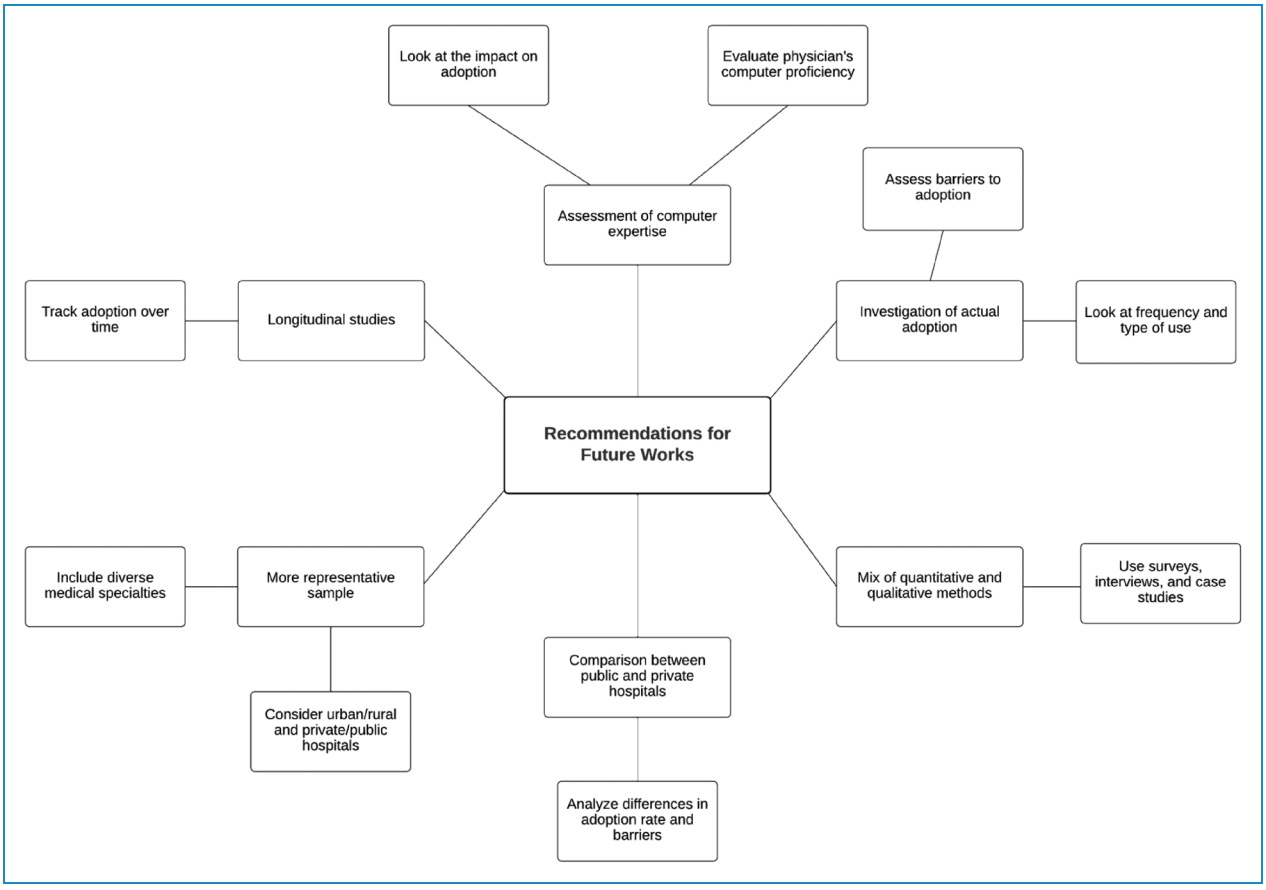

Figure 9. Mind-map of the recommendations.

proficiency with technology. Understanding the impact of physicians' technological skills on EMR adoption is crucial for tailoring implementation strategies and ensuring the successful integration of technology into healthcare practices.

In summary, these recommendations advocate for a holistic and contextually aware approach for researching EMR adoption. By incorporating these strategic considerations, researchers can contribute meaningful insights that pave the way for enhanced healthcare technology implementation and, ultimately, improved patient care.

Conclusion

This study aimed to perform a systematic review of the technology adoption of EMRs from physicians' perspective that is obtained by the inadequate number of research that offers a comprehensive synthesis of the literature studies that have been conducted with the same objective. Furthermore, this study aimed to synthesize the related literature on the adoption of EMRs in developing economies. The authors used the PRISMA flow diagram to show the flow of the study at each stage of the review process. They searched for articles in Google Scholar using various keywords and applied priori inclusion and exclusion criteria to select eligible articles. Out of the 1160 articles found, 21 were finally selected for analysis after screening titles, keywords, and conducting a context review. The 21 selected studies were published between 2007 and 2021, with the most of them being published between 2019 and 2021.

The common method used to collect data in these studies was through questionnaires (15 studies) and interviews (6 studies). The significance of EMR adoption in developing economies is reflected by the substantial number of studies conducted in Ethiopia, Iran, and Ghana, indicating the need for further research in this area. The results of these studies have the potential to inform future research and to guide the development of practical strategies that promote successful EMR implementation in these regions. The technology adoption of EMRs and their impact on healthcare is an increasingly important and well-invested area of study. The results emphasize the necessity for ongoing research and exploration in the field to ensure efficient and effective implementation of technology in healthcare. The sample literature demonstrates a rich and diverse field of study in the realm of technology and its

applications, with a growing interest in the integration of information technology in healthcare and its effects on various industries. Additionally, the results show a commitment toward improving the human experience through technology and education and highlight the interdisciplinary nature of the field with a wide range of topics being investigated. These findings provide valuable insights into the current state of the field and can function as a guide for future research and development.

This study also aimed to discern the key factors that impact EMR adoption as perceived by physicians, with the UTAUT model which was used as the basic framework to analyze the end-users' intention in utilizing EMRs and integrated the concepts of the ATT of the TAM into the final analysis to determine the physicians' intention of using EMRs. Based on the findings of the study, it can be concluded that several key factors play a role in the physicians' intention to use EMR systems. These factors include PE, EE, SI, FC, ATT, and BI. The results showed that PE and FC have a positive impact on the actual use of EMR systems, while EE and SI have a positive impact on the attitude toward using EMRs. Additionally, ATT and BI have a direct positive effect on the behavioral intention to use EMRs. These results suggest that to increase physician adoption of EMR systems, it is important to take into consideration the major five enabler factors such as computer literacy, education, feature of the system, voluntariness, and system functionality that are perceived to impact EMR adoption.

The barriers to EMR adoption as identified in various studies include resistance to changes, lack of technical knowledge, lack of interoperability, concerns about privacy and security, financial constraints, and time constraints. Other factors that contribute to the slow adoption of EMR systems include the lack of user-friendly interfaces, integration issues with existing systems, and limited training opportunities. Additionally, the lack of standardization and the complexity of EMR systems can also pose significant challenges for healthcare organizations looking to adopt these systems. The study found that there is a disparity between the identified barriers and enablers of EMR adoption in developing economies, with more barriers being identified. This suggests that the implementation and utilization of EMRs in these economies is still in the early stages and there are many challenges that need to be addressed; thus, the findings in this study further shed light on key facilitators and constraints for EHR deployment.

In conclusion, this research underscores the importance of addressing facilitators and constraints in HER deployment, particularly in the context of physicians' EMR adoption in developing economies. We have identified the need for further research to explore the enablers and barriers, guide EMR development, and inform healthcare policies.

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Appendix A: List of Journals Used in the Literature Review.

Reference No.	Author & Year	Title
Ref.[6]	Williams and Boren 2008	The role of electronic medical record in care delivery in developing countries
Ref.[12]	Awol et al. 2020	Health Professionals' Readiness and Its Associated Factors to Implement Electronic Medical Record System in Four Selected Primary Hospitals in Ethiopia
Ref.[13]	Khan et al. 2012	Hopes and Fears in Implementation of Electronic Health Records in Bangladesh
Ref.[29]	Ahmed et al. 2020	Intention to use electronic medical record and its predictors among health care providers at referral hospitals, north-West Ethiopia, 2019: using unified theory of acceptance and use technology 2(UTAUT2) model
Ref.[35]	Hossain et al. 2018	Investigating factors influencing the physicians' adoption of electronic health record (EHR) in healthcare system of Bangladesh: An empirical study
Ref.[36]	Abdekhoda et al. 2014	The effects of organizational contextual factors on physicians' attitude toward adoption of Electronic Medical Records
Ref.[37]	Adwan and Berger 2015	Exploring physicians' behavioral intention toward the adoption of electronic health records: an empirical study from Jordan
Ref.[38]	Spatar et al. 2019	Adoption factors of electronic health record systems
Ref.[39]	Sayyah Gilani et al. 2016	EMR continuance usage intention of healthcare professionals
Ref.[41]	Berihun et al. 2020	Willingness to Use Electronic Medical Record (EMR) System in Healthcare Facilities of Bahir Dar City, Northwest Ethiopia
Ref.[42]	Shiferaw and Mehari 2019	Modeling predictors of acceptance and use of electronic medical record system in a resource limited setting: Using modified UTAUT model
Ref.[43]	Badran 2019	eHealth in Egypt: The demand-side perspective of implementing electronic health records
Ref.[44]	Ebnehoseini et al. 2020	Understanding key factors affecting on hospital electronic health record (EHR) adoption
Ref.[45]	Jianxun et al. 2021	Electronic health records adoption: Do institutional pressures and organizational culture matter?
Ref.[46]	Sequist et al. 2007	Implementation and Use of an Electronic Health Record within the Indian Health Service
Ref.[47]	Scholl et al. 2011	A case study of an EMR system at a large hospital in India: Challenges and strategies for successful adoption
Ref.[48]	Biruk et al. 2014	Health Professionals readiness to implement electronic medical record system at three hospitals in Ethiopia: a cross sectional study
Ref.[49]	Jawhari et al. 2016	Barriers and facilitators to Electronic Medical Record (EMR) use in an urban slum
Ref.[50]	Sharikh et al. 2020	The impact of electronic medical records' functions on the quality of health services
Ref.[51]	Parks et al. 2019	Electronic health records implementation in Morocco: Challenges of silo efforts and recommendations for improvements
Ref.[52]	Abdulai and Adam 2020	Health providers' readiness for electronic health records adoption: A cross-sectional study of two hospitals in northern Ghana

Appendix B: List of Abbreviations.

Abbreviation	Meaning
AI	Artificial Intelligence
ATT	Attitude
BI	Behavioral Intention
EE	Effort Expectancy
EHR	Electronic Health Record
EMR	Electronic Medical Records
FC	Facilitating Conditions
HIT	Health Information Technology
HCP	Healthcare Providers
PE	Performance Expectancy
PEOU	Perceived Ease Of Use
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analysis
PU	Perceived Usefulness
SI	Social Influence
TAM	Technology Acceptance Model
TAM3	Technology Acceptance Model Three
UTAUT	Unified Theory of Acceptance and Use of Technology
UTAUT2	Unified Theory of Acceptance and Use of Technology Two
WoS	Web of Science