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Types of Electronic Health Records Designed in Iran: A Systematic Review

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ABSTRACT

Aims The Electronic Health Record is a collection of medical information about a person's health status. The development of electronic health records has occurred worldwide, and developing countries, including Iran, have been no exception and have tried to take action in this regard. Therefore, this study aimed to review the types of Electronic Health Records designed in Iran.

Information & Methods This systematic review was conducted without any time limitation until 12 June 2022 by searching the keywords "Electronic Health Record", and "Iran", and their synonyms in the Web of Science, PubMed, Scopus, SID, and Magiran databases, and Google Scholar search engine. Published articles on the development or design of electronic health records in Iran were reviewed.

Findings Among 28 papers, 11, 6, and 11 records were designed in Electronic Health Record, Electronic Medical Record, and Personal Electronic Record formats, respectively. Approximately 46% of the studies only designed electronic records but never implemented them, and the rest (54%) had completed the electronic record development. Among 15 implemented records, 7, 4, and 4 were in Personal Electronic Record, Electronic Health Record, and Electronic Medical Records formats, respectively. In addition, implementation platforms for records were in the form of web-based, mobile-based, and windows-based applications. Most of the minimum data set in the designed records were demographic data, medical history, therapeutic procedures, and laboratory tests.

Conclusion Designing various Electronic Health Record systems for different diseases and clinical conditions can be an effective step toward developing a national Electronic Health Record.

Keywords Electronic Health Records; Electronic Medical Records; Personal Health Records; Iran

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Introduction

Medical information contained in medical records is very significant so that their appropriate management can lead to the growth of medical knowledge and the development of healthcare in a country and allow managers of different levels to provide accurate, comprehensive, and timely information for decisions and policies and minimize wrong decisions [1, 2].

Patients' medical records can be stored in various forms, e.g., paper, electronic, microfilm, or a combination of several formats, depending on the policies of the healthcare institution. Due to their inherent limitations, paper records cannot properly link healthcare providers and process data into actionable information, and their timely access is physically limited to one location, one user, and one time. Furthermore, organizing data and determining their temporal precedence is sometimes difficult and time-consuming [3]. On the other hand, information technology evolution has led to the move to computer information systems since the mid-1970s. Information technology improves the quality of healthcare and leads to the development of clinical systems [4, 5]. Moreover, Byrd noted that new health information systems can improve the quality of health information because of their better design, the use of structured data elements, drop-down menus, and instantaneous and point-of-care records of patient information by service providers [6].

The ultimate objective of these systems was to digitize health records and access Electronic Health Records (EHRs).

The EHR is an extensively accessible, understandable, and lifelong tool that collects personal health information electronically and is recorded, verified, and shared by healthcare providers [7-9]. The EHR includes critical medical information for diagnosis and treatment in healthcare on health status, physician visits, hospitalization, laboratory results, radiological findings, nursing documentation, and prescription medicines. It also potentially reduces drug interactions and side effects, as well as makes the tasks easier and saves patients' time [1]. Other functions of these EHRs include the ability to process, store, preserve, and transfer information by computer and, if necessary, make the information available to authorized people [10]. The EHRs have improved the quality of service delivery, reduced errors, and allowed integrated access and display of all patient data as the primary objective of the EHR [11].

The use of EHRs is significantly widespread nowadays. According to a study, only 12.2% of US hospitals had this basic system in 2009, and this percentage increased to 75.5% by 2015 [12]. This increase in the application could be due to the impact of EHRs on improving patient care.

According to Wigeman [13], five infrastructures are required to design and implement EHR system, including (i) Automatic Medical Records, (ii) Computer Medical Records, (iii) Electronic Medical Records (EMRs), (iv) Electronic Patient Records (EPRs), and (v) Electronic Health Records (EHR). In today's healthcare settings, healthcare organizations are striving to achieve a legal Electronic Medical Record system for their physicians and staff and have provided some of the infrastructures in their organizations. The EMRs are computer information systems that collect, store, and display patient information and typically replace paper-based medical records [14]. The EMR system was implemented in November 2017 in a breast cancer service in Western Sydney, Australia. Convenient and timely access to all patient information, ensuring the accuracy of record information, and reducing bias due to the timely entry of information into the records are among the advantages of implementing an EMR system in this center. Moreover, EMR was especially appreciated by the center's staff due to its easy documentation, time savings, complete record accuracy, clinical consultations, and highlighting of cases that should be recorded [15].

Another type of EHRs that has attracted much attention is the Personal Health Record (PHR), which is a self-managed tool [16]. Promoting patient engagement in health care delivery and people's interest in accessing their EHRs make PHRs interesting. This type of record system through self-care has a significant role in improving the health and awareness of individuals and controlling symptoms [17]. The experience of the UK National Health Service in implementing a PHR system called "Health space" for diabetes management showed that this system has excellent potential to improve safety and care efficiency, and patients can check the accuracy of their summary care record and access detailed information about their health [18].

Such projects on the development of EHR and other types of electronic record systems have been implemented in many countries. Several studies have also been conducted in Iran, and record systems have been designed for different groups of patients. Some of these record systems have been designed to the level of determining the data elements of system, and some have reached the stage of creation and implementation. According to the literature, there is no comprehensive research on the types of EHR systems designed in Iran. This study aimed to review the types of these systems in Iran systematically.

Information and Methods

This study was done in 2022. We followed PRISMA guidelines to review the types of EHRs designed in Iran.

Eligibility criteria

Original articles about the design or development of a type of EHR system in Iran were included in the study. All brief reports, letters to the editor, conference abstracts, observational studies, review articles, and articles with no available full text were excluded from the study process.

Information sources and search strategy

Web of Science, PubMed, and Scopus databases and Google Scholar search engine were used for retrieving English papers, as well as SID and Magiran databases were applied for retrieving Persian papers in this regard. Searching in databases was done on 12th June 2022 with no time limitation. The search strategy consisted of two concepts namely “Electronic health record” and “Iran" (Table 1), which were designed by two authors (Z.J. & F.A.). Moreover, the results were limited to English-language and Persian-language journal papers.

Study selection

The acquired articles based on the search strategy were inserted into the EndNote reference management software. At first, duplicate records were identified and removed through the software. Then the title and abstract of all studies were reviewed in terms of the eligibility criteria and if needed the full-texts were screened in detail.

The selection process was performed independently by two researchers, and if there was any contradiction discrepancy, it was referred to the third researcher.

Data extraction

Following the study selection according to the study inclusion and exclusion criteria, data were collected using a data extraction form based on the study objectives, which included the first author's name and study date, study location, study design, the aim of the study, type of electronic record, target disease or condition, Minimum Data Set (MDS), record user, and record implementation platform.

Table 1. Resource search strategy in scientific databases

Time limitation	Till 12 June 2022
Language limitation	English and Persian
Databases	Web of science, PubMed, Scopus, Google scholar, SID, Magiran
PubMed	((((((((("Electronic medical record") OR ("Patient health record")) OR ("Patient medical record")) OR ("Digital health record")) OR ("Digital medical record")) OR ("Electronic record")) OR ("Electronic personal health record")) OR ("Electronic health record")) OR ("Personal health record")) OR ("Health record")) AND (IRAN)
Scopus	TITLE-ABS-KEY ("Electronic medical record") OR TITLE-ABS-KEY ("Patient health record") OR TITLE-ABS-KEY ("Patient medical record") OR TITLE-ABS-KEY ("Digital health record") OR TITLE-ABS-KEY ("Digital medical record") OR TITLE-ABS-KEY ("Electronic record") OR TITLE-ABS-KEY ("Electronic personal health record") OR TITLE-ABS-KEY ("Electronic health record") OR TITLE-ABS-KEY ("Personal health record") OR TITLE-ABS-KEY ("Health record") AND TITLE-ABS-KEY ("IRAN")
Web of Science	TOPIC: ("Electronic medical record") OR TOPIC: ("Patient health record") OR TOPIC: ("Patient medical record") OR TOPIC: ("Digital health record") OR TOPIC: ("Digital medical record") OR TOPIC: ("Electronic record") OR TOPIC: ("Electronic personal health record") OR TOPIC: ("Electronic health record") OR TOPIC: ("Personal health record") OR TOPIC: ("Health record") AND TOPIC: ("IRAN") Indexes=SCI-EXPANDED, SSCI Timespan=All years

Findings

A total of 715 papers were retrieved through the initial review of five databases and the Google Scholar search engine. After removing duplicate and irrelevant papers based on the evaluation of the title, abstract, and full text, finally, 28 papers were selected that were published to introduce or review the EHR system designed in Iran. A summary of the search and selection process is shown in the PRISMA diagram (Figure 1).

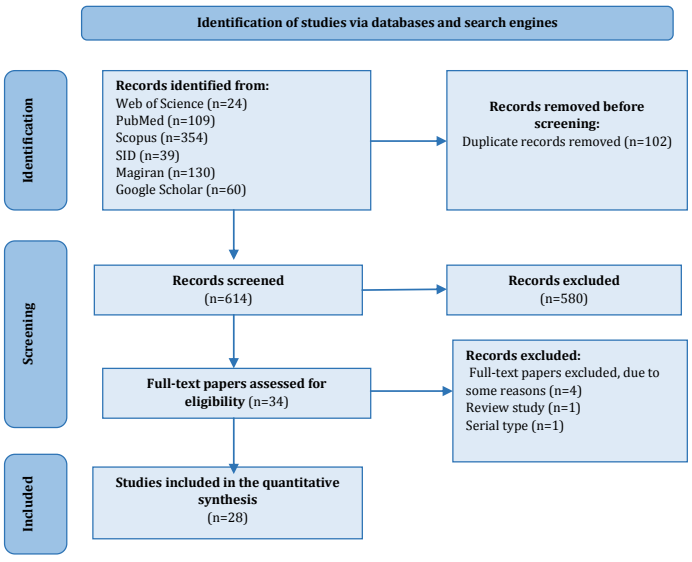

Figure 1. PRISMA flow diagram

Characteristics of the studies

The results of 28 studies revealed that most projects on designing electronic records had been published in descriptive, descriptive-analytical, descriptive cross-sectional, and applied developmental in Iran. Approximately 46% of the studies (13 out of 28) only designed electronic record systems but did not implement them. However, some studies had implemented the designed record system after publishing their previous paper on determining the record MDS in their subsequent study. As observed in the studies conducted by Moeil Tabaghdehi *et al.* [5, 19], researchers published data on determining MDS of personal EHRs for patients with thalassemia major in an article in 2018. Then in the subsequent study, they developed this record system and presented the steps of its development and implementation. Similarly, in Tanhapour and Safaei's projects for designing and modeling a social health media as a PHR system, two original papers [20, 21] were published, which provided information on determining the MDS and the steps of developing and implementing electronic personal health records, respectively.

Types of electronic records

Out of 15 record systems, 4, 4, and 7 were implemented in EHR, EMR, and PHR formats, respectively. The EHR systems were implemented for infertility, uveitis, asthma, hydatidiform mole, diabetes, glaucoma, as well as school students' health information, chemical victims' health information, and national health record. In addition, EMRs were performed for mental illness, infertility, diabetes, diabetic foot ulcers data, and neonatal health information. PHRs were designed for major thalassemia, gestational diabetes, chronic kidney disease, chronic heart failure, type 2 diabetes mellitus, inflammatory bowel disease, athlete health status, student health information, and a general personal health record.

Implementation platforms

Out of 15 records, a total of 11 records (major thalassemia, hydatidiform mole, infertility, chronic kidney disease, type 2 diabetes, glaucoma, chronic heart failure, inflammatory bowel disease, athlete health status, neonatal health, and general personal health records) were developed as "web-based", two records (gestational diabetes and oral health records) were designed as "mobile application", and two records (elementary students' health records and diabetes) were performed as "windows-based application". It is noteworthy that the personal health record system designed in the study of Tanhapour and Safaei [20] was based on Web 2.0 and was developed in the social media.

Users of electronic records

The users of PHRs related to major thalassemia, gestational diabetes, type 2 diabetes, and chronic kidney disease were the "patients" with those diseases, and the users of PHRs related to students were from the "student" community. "Health care providers" were the users of records of uveitis disease, mental disorders, hydatidiform mole, infertility, diabetes, asthma, diabetic foot ulcer, chronic kidney disease, glaucoma, electronic records of infants, elementary students, chemical victims, and electronic national health records. In addition, users of diabetes, chronic heart failure, inflammatory bowel disease, athletes' health status, and oral health were "patients and health care providers"; while users of public personal health records were "patients, health care providers, and health care organizations".

Minimum data sets

Most of the data items that were considered in MDS of designed records were related to demographic data (85.71%), medical history (60.71%), therapeutic procedures (32.14%), diagnostic procedures (32.14%), and laboratory tests (32.14%), in respective order.

More detailed information on the types of EHRs designed in Iran is provided in Table 2.

Table 2. Characteristics of the included studies

Author, Study date	Aim of the study	Type of the electronic record	Target disease/ condition	Minimum Data Set (MDS)	User	Implementation platform
Salehi [22], 2021	To identify the core data sets and required functionalities for designing a PHRs for chronic kidney disease (CKD) management and assess their validity	PHR	Patients with chronic kidney disease	1. Problem list 2. Surgical procedures 3.Diagnosis/comorbid conditions 4. Medications list 5. Risk factors & allergies 6. Demographics data 7. Health maintenance 8. Disease characteristic 9. Advance directives 10. Physical examination 11. Wellness management 12. Care plan 13. Health summary 14. Family record& history 15. Genetic data 16. Health patterns 17. Test and examination 18. Functional status	Patients	Not implemented

Ghazi Saeedi [23], 2021	To determine the Minimum Data Set (MDS) essential for diabetic foot patients' electronic medical records	EMR	Diabetic foot patients	**Demographic information section:** 1. Admission information 2.Finance information 3.Reporting information 4. System capability **Clinical information section:** 1. History 2. Wound information 3. Lower limb information 4. Wound management 5. Para-clinical results 6. Follow-up	Healthcare providers	Not implemented
Farzandipour [24], 2021	To design an e-PHR system and assess its usability for patients with chronic heart failure	PHR	Patients with chronic heart failure	1. Identity Information 2. Vital signs 3. Diet and liquids 4. Health records 5. Symptoms 6. Medications 7. Vaccination 8. Tests 9. Social records 10. Physical Activities 11. Sexual activities 12. Travel 13. Reminders 14. Trainings	Healthcare providers, and Patients	Web-based
Aalipour [25], 2020	To determine the minimum data set for user profile or user's electronic health record in chemical warfare victims' recommender system	EHR	Chemical warfare victims and war survivors	47 nonclinical data elements, And 181 clinical data elements	Healthcare providers	Not implemented
Hashemi [26], 2019	To determine the data elements required for EMRs in the field of mental disorders	EMR	Patients with mental disorders	1. Demographic data of patients 2.Administrative data of physicians 3. Administrative data of patients, 4.History 5.Clinical data 6. Treatment 7.Financial data	Healthcare providers	Not implemented
Abbasi [27], 2019	To evaluate the current demographic and clinical minimum data sets (MDSs) of Iranian National Electronic Health Record (known as SEPAS) and to identify most necessary data elements	EHR	Public	**Current demographic and clinical:** - Patient's name, - Surname, - Father's name, - Nationality, - Cell number, - Job, - Residential address, - Residence place, - Passport number (for non-Iranian patients), - Diagnosis date, - Death time, - Death place **Recommended data elements:** - Demographic data (Patient unit number, Age, Province, City, The deceased person's full address) - Delivery and childbirth (Type of delivery, Number of newborns, Birth order, Newborn weight, Newborn Health status, Congenital anomalies, Newborn unit number) - Patient examinations (Main complaints, Primary diagnosis, Diagnosis during treatment, Physician orders, Underlying disease, Family history) - Vital signs (Systolic blood, Diastolic blood) - Operations (Operation name, Type of operation (outpatient, inpatient), Date of operation) - Anesthesia (Type of anesthesia) - Allergies (Type of allergy, Allergens) - Specific patient conditions (Pregnancy or breastfeeding, Prosthesis in patient body) - Medications (Medication name, Patient medication history) - Blood type (Blood group, Rh)	Healthcare providers	Not implemented

Safdari [28], 2019	To develop electronic health records for patients with hydatidiform mole and evaluation of completeness of medical records	EHR	Patients with hydatidiform mole	1. Demographic information 2. Clinical information 3. Complementary drugs 4. Diagnostic procedures 5. Therapeutic procedures 6. Therapeutic drugs and chemotherapy 7. Follow-up	Healthcare providers	Web-based
Sadoughi [29], 2018	Determine the minimum data elements of asthma for the electronic health record in Iran	EHR	Patients with asthma	**Managerial data elements:** 1. Demographic data 2. Discharge data 3. Insurance data 4. financial data **Clinical data elements:** 1. Rick factors 2. Diagnosis 3. Treatment 4. Asthma education to patient	Healthcare providers	Not implemented
Shahbazi [30], 2018	To determine the essential MDS for uveitis patients' electronic health records	EHR	Patients with uveitis disease	1. Demographic information 2. Patients' clinical records 3. Comorbidities 4. Patient's main complaint 5. Patient's non-ocular clinical manifestations 6. Patient's eye examination 7. Type of uveitis 8. Treatment guidelines 9. Non-pharmacological care 10. Information of ophthalmic pictures 11. laboratory information	Healthcare providers	Not implemented
Tanhapour & Safaei [21], 2018	To describe the needed requirements for developing the proposed hybrid PHR model in a social network	PHR	Public	1. Basic information 2. Health information 3. Administrative, financial and support information 4. Social network services	Healthcare providers, patients, and healthcare organizations	Not implemented
Moeil Tabaghdehi [5], 2018	To determine the data set for personal health record of patients with major thalassemia	PHR	Patients with major thalassemia	1. Demographic information 2. Health History 3. General physical examinations 4. Biochemical data 5. Hematological data 6. Immunological data 7. Pharmaceutical data 8. Blood transfusion data 9. Physical tests data 10. Vaccination 11. Dental care	Patients	Not implemented
Ghazi Saeidi [31], 2018	To determining the Required Minimum Data Set and Data Elements for Glaucoma Patients.	EHR	Patients with glaucoma	1. Patient's records 2. Demographic data 3. Clinical data	Healthcare providers	Web-based
Rezaee [32], 2018	To design and implementation of web-based personal health record for patients with inflammatory bowel disease	PHR	Patients with inflammatory bowel disease	1. Demographic information 2. Diagnostic information 3. Follow-up 4. History 5. Public information 6. Specific disease information	Healthcare providers, and patients	Web-based
Asgari [33],2018	To explain the project of designing a system for Electronic Oral Health Record (EOHR)	EHR	Oral health	1. Demographic information 2. Follow-up 3. Socioeconomic status of family 4. Oral health-related behavior 5. Dental health 6. Gingival status 7. Quality of life	Healthcare providers and patients	Mobile application
Moeil Tabaghdehi [19], 2018	To develop personal electronic health records for thalassemia major patients.	PHR	Patients with thalassemia	1. Demographic information 2. Medical History 3. Body examinations 4. Biochemistry data 5. Hematological data 6. Immunological data 7. Pharmaceutical data 8. Blood injection data 9. Physical test data 10. Vaccination 11. Dentistry	Patients	Web-based

Farzandipour [34], 2017	To design information requirements of electronic health records of infertility centers	EHR	Infertile patients	**Para-clinical information:** 1. Couples test results data 2. Couples medical imaging results **Clinical information:** 1. Females' current diseases history 2. Females' reproductive system history 3. Pregnancy history 4. Females' sexual and infertility history 5. Male problems and diseases 6. Males' case history 7. Previous medical and surgical history of couples 8. History of couples' diseases 9. Couples' consultation 10. Couples' treatments 11. Couples' infertility diagnose	Healthcare providers and patients	Not implemented
Ghazisaeedi [35], 2017	To design an electronic record based on the traditional medicine approach for infertile patients	EMR	Infertile patients	1. Personal information 2. Reviewing of body systems 3. Examination 4. Disease history 5. Medical history 6. Diagnostic procedures (For male and female) 7. Checking of seminal fluid 8. Therapeutic procedures	Healthcare providers and patients	Web-based
Safdari [36], 2017	To design the elementary school students' health measurement electronic record	EHR	Children and elementary school students	1. Demographic information 2. Social information 3. Screening examinations 4. Physical activity 5. Physical examinations	Healthcare providers and patients	Windows-based application
Kamel Ghalibaf [37], 2017	To design and implement an information provision system based on the medical records of diabetic patients and to investigate the attitudes of users toward using this product	EMR	Diabetic patient	1. Demographic information 2. Symptoms 3. Medical history 4. Medication 5. Lab tests 6. Measurements	Healthcare providers and patients	Windows-based application
Tanhapour & Safaei [20], 2017	To design the architecture of personal health record system in the health social network platform	PHR	Public	1. Basic information 2. Health information 3. Administrative, financial and support information 4. Social network services	Healthcare providers, patients, and healthcare organizations	Web-based (Health Social Network-HSN)
Rezaei [38], 2016	To design an electronic medical record system for infants hospitalized in neonatal intensive care unit at the Hospitals of Tabriz University of Medical Sciences.	EMR	Infants	1.Demographic information 2. Hospitalized information 3. Risk factors information 4. Disease assessment and procedures information 5. Disease information 6. Diagnostic information 7. Discharge information	Healthcare providers	Web-based
Safdari [39], 2016	To design an electronic medical record for chronic kidney disease	EMR	Patients with chronic kidney disease	No information	Healthcare providers	Web-based
Azizi [40], 2016	To examine the impact of a web-based diabetic personal health record (DPHR) on the self-care status of diabetic patients as compared with the control group	PHR	Type 2 diabetic patients	No information	Patients	Web-based
Langarizadeh [41], 2016	To develop a personal health record application for gestational diabetes	PHR	Women with gestational diabetes	1. Demographic information 2. Medical history 3. Date of delivery and gestational age 4. Lab results and ultrasound 5. Recording of measurements 6. Reminder of medicine 7. Recording of medical information 8. High-risk symptoms 9. Guides	Patients	Mobile application

Samadpour [42], 2015	To determine the optimal data set of electronic PHR system for Iranian students of medical sciences	PHR	Students of medical sciences	1. Demographic information 2. Admission information 3. Physiological information 4. Summary of clinical information 5. Vital signs 6. Health record	Students	Not implemented
Babalhavaeji [43], 2014	To investigate the various information needs of Electronic Health Records of dialytic patients from endocrinologist perspective	EHR	Diabetic patients	1. Demographic information 2. Tonometry 3. Public information of diabetic patients 4. History of treatment 5. Treatment of diabetic patients 6. Laboratory tests 7. Patient's referral to specialized clinics	Healthcare providers	Not implemented
Abdolkhani [44], 2014	To develop an electronic personal health record for professional Iranian athletes	PHR	Athletes	1. Demographic information 2. Health history 3. General examinations 4. Injury report 5. Laboratory tests 6. Medications 7. Surgeries 8. Physiotherapy 9. Nutrition 10. Dentistry 11. Immunization	Athletes, team physicians, physiotherapists, athletic trainers, sport support personnel (psychologist, massage therapist, dietitian, orthopedic surgeon, cardiologist, etc.) and an expert in information management who plays the role of system administrator	Web-based
Ahmadi [45], 2012	To investigate the various information needs of Electronic Health Records of dialytic patients from nephrologists' viewpoints	EHR	Diabetic patients	1. Demographic information 2. Public information 3. Diagnostic information 4. Treatment information 5. Patient's history 6. Patient's status 7. Other related information	Healthcare providers	Not implemented

Discussion

This study aimed to investigate electronic record systems designed in Iran, and the papers related to designed electronic record systems were reviewed systematically. Some of the designed record systems have only reached the stage of determining the information elements of the record systems and design of the overall structure of the record systems, while others have reached the stage of their implementation. According to the literature results, the designed electronic records were in multiple levels of PHR, EMR, and EHR. In Afrizal *et al.*'s study [46] on the barriers to preparing EHRs in primary healthcare, these three types of records were referred to as electronic records used in primary care. Each of these record systems has its structure and application, so it is justifiable that in several studies, a specific type is developed for any purpose of electronic record design. In studies whose main purpose is to design a record that the patients can record and manage their health information, such as the investigations conducted by Moeil Tabaghdehi *et al.* [19] and Langarizadeh *et al.* [41], the record is of the type "PHR".

According to the literature, approximately 39% of studies (11 out of 28) only designed electronic record systems and did not implement them, which can be due to the lack of required infrastructure to implement these projects in Iran. Jahanbakhsh *et al.* [47] investigated the challenges of implementing EHR in Iran. They addressed infrastructure challenges (e.g., implementation costs, non-acceptance of EHR by many users, and lack of expertise for system maintenance) and structural challenges (e.g., the lack of an appropriate format for data entry, the shortage of data retrieval and editing services, and not enough attention to data integrity from birth to death), all of which can be true for designed records in studies.

It is noteworthy that among references in the present study, 7 out of 15 implemented records are in PHR format, and their users are patients and community members, which shows that the PHR system is more straightforward to implement than other types of electronic record systems. Moreover,

it has a higher level of acceptance among its specific users. According to a study conducted by Mansour [48] in 2018 to evaluate patients' perspectives on the application of the PHR system in Egypt, PHR users showed a great desire to apply it and reported its usefulness and usability as the most important factors influencing their willingness to use this type of health record system. On the other hand, the growth of the importance of patient engagement in their care process is another reason for the widespread attention to the development of personal electronic records [49].

Another important issue related to the designed and implemented records in this study is the record implementation platform. Among 15 implemented records, 11, 2, and 2 were Web-based, in the form of mobile applications and Windows-based applications, respectively, which can be a big challenge when integrating electronic records. Heart *et al*. [50] also mentioned this in their study and considered the implementation of electronic records on different platforms as an important technological challenge in the integration and interoperability between records. According to the researchers, the content of the records may differ for data models, schemas, contracts, and the detail levels used to display similar data, which can make it challenging to integrate the types of records [50]. Therefore, these challenges must be considered by managers and developers to develop a comprehensive and integrated EHR.

The study of the Minimum Data Set (MDS) of designed electronic records is the next important issue addressed in this research. According to Sadoughi *et al*. [51], determinng the MDS is one of the most important steps in developing electronic health systems. The EHRs are no exception to this issue, and the determination of the MDS for the record systems in the types of EHRs of the studies was considered one of the important design steps. The study of these elements indicated that most of the data items considered in the types of designed records were related to demographic data, medical history, therapeutic procedures, diagnostic procedures, and laboratory tests. This result is consistent with the results of important information elements confirmed in the studies of Mahmoudvand *et al*. [52], Weintraub *et al*. [53], and Abbasi *et al*. [54]. The generality of these elements and their high importance are the reasons for the presence of these elements in any type of medical record. However, specific information elements of health status are also considered in every electronic record, depending on the type of disease or situation in which the electronic record was designed or developed.

Inaccessibility to the full text of some papers was one of the limitations of this study. In addition, in line with the study objective, only electronic records designed in Iran were reviewed; therefore, it is recommended that studies be conducted on the records designed and developed in other countries to achieve more accurate results on the electronic health records.

Conclusion

Designing EHRs for various diseases and clinical conditions can be an effective step towards developing a national EHR. For this purpose, determining the stakeholders' information requirements is of great importance. The results of this study can be considered as a comprehensive basis for developing a national EHR in Iran. A basis can be provided to develop a complete record taking into account the most important health factors related to the health of people in the community by considering the fundamental information elements of the types of records designed (e.g., demographic data, medical history, therapeutic procedures, diagnostic procedures, and laboratory tests), and the specific information elements of records. Furthermore, the results of this study can assist system administrators and developers in selecting an appropriate and integrated platform for developing national EHRs. Researchers can also use the results of the present study as a guideline and roadmap to compare data elements and features of EHRs designed or developed in Iran and think of solutions to solve the weaknesses of record systems with information deficiencies.

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