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Errors and causes of communication failures from hospital information systems to electronic health record: a record-review study

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Highlight

- This is the first study underpinning errors in the communication of information from HISs to an EHR.

- Information communication between 3 common HISs and EHR was examined.

- Determining the communication barriers improves the effective use of data at a national level.

Abstract

Introduction: Failure in the communication of information and partial communication of information between hospital information systems (HIS) and the Iranian electronic health record

(SEPAS) reduces the quality of information. The objective of this study was to identify the errors and causes of failure in the communication of patients' information from HISs to SEPAS.

Methodology: This descriptive-analytic study was conducted in the first quarter of 2016. In this study, 882 records which had failed to be sent from three hospital information systems to SEPAS were reviewed and data were collected using a data collection form. Data were analyzed using descriptive and inferential statistics with SPSS.18.

Results: The review of 882 hospital records resulted in the identification of 1256 errors of 41 different types. These errors were classified into 4 categories: administrative-financial errors (61%), errors related to national codes (23%), clinical errors (9%), and other errors (7%). In total, errors were categorized into two generic types: "system level errors (65%) and operator-dependent errors (35%)". The number of errors was a significant difference in the studied hospitals (p <0.0001).

Conclusions: This study identified a large number of system and operator-dependent errors hampering communication of information from HIS to SEPAS. Results revealed that the same hospital information systems used in different hospitals could face dissimilar types and levels of errors when communicating with other information systems. The results of this study can be used by system designers and health center policymakers to prevent the problems of information communication between health information systems.

Keywords: Electronic Health Record; SEPAS; Hospital information systems; information communication; errors.

Introduction

Electronic health record (EHR) has widely been used in many healthcare organizations to improve safety, quality and efficiency of patients care[1-3] Many of these organizations have been engaged

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in the development and implementation of different electronic health records and electronic documentation systems since 2005.[4] Based on a definition by World Health Organization, EHR collects and provides lifetime health information of every person and encompasses all his encounters including outpatient, inpatient or emergency visits.[5] Developing countries, including Iran, have taken some steps to employ computer-based technologies such as EHR in their healthcare systems. In Iran, the notion of Electronic Health was formed in 2001. Subsequently, the Iranian Electronic Health Record (SEPAS) and health smart cards for whole Iranian population projects were introduced in 2007.[6]

Health information is mainly used in various fields such as education, treatment, research as well as for various types of assessment, planning, and policy-making related to health management. To meet these goals, it must be collected, stored and analyzed properly. Following the emergence of EHR, its future use and the communication of information with other health information systems has been the subject of many discussions.[7] Studies have shown that appropriate communication of health information among different information systems and care centers can reduce costs[8] increase patient's safety[9] and improve access to patient's information.[10] Nowadays, a large amount of patients' information is communicated to and stored in SEPAS. Proper and successful communication of information ensures the appropriate use of collected information for future use. Medical universities in Iran are responsible to continuously review and monitor the quality of the data communicated to SEPAS and refine these data and remove their errors before communication.[11] To be certified by Ministry of Health, companies providing hospital information systems are required to root out factors leading to errors in communication of information to electronic health record. Otherwise, they are not allowed to continue their activities in healthcare organizations.[12-14]

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Failure to communicate information between hospital information systems and electronic health record or incomplete communication brings about the following problems. It reduces the quality of information collected and stored in the Ministry of Health databases and consequently results in ineffective use of the information in the future. Hence, identifying and removing the barriers to this process would improve the interaction between hospitals and Ministry of Health, and lead to the effective use of the data collected at the national level. Few studies have been conducted on the communication of information between health information systems and the electronic health record.[15, 16] In Iran, no study has been carried out on this subject. Most studies conducted on SEPAS have focused on designing and developing a minimum data set of hospital information subsystems for communication to Iranian electronic health record or on comparing SEPAS with electronic health records.[17-20] Identifying and resolving causes and factors impeding the communication of information to the electronic health record can help to improve the quality of healthcare information. The aim of this study was to identify possible errors in the communication of patients' information from hospital information systems to SEPAS and the causes its miscommunication.

Methods

Study design and setting

This record-review study was conducted in the first quarter of 2016. In this study, patients' records that their information had failed to be communicated from three hospital information systems (Payvand Dade, Tiraje, and Rahavard Rayane) to SEPAS were evaluated in terms of causing errors. These systems are used in 186, 60 and 40 hospitals in Iran, respectively. Each of these systems contains nursing information system (NIS), laboratory information system (LIS), pharmacy information system (PIS), radiology information system (RIS) subsystems. Moreover,

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they have a module for communication of patients' information to SEPAS. The main functionalities of these systems include documenting nursing, radiology imaging and pharmaceutical services, as well as, requesting lab tests and reporting results, and serving hospital accounting.

Data flow from HISs to SEPAS

Data elements in SEPAS are categorized in two groups; optional and mandatory. Mandatory data element refers to data items such as national ID codes, final diagnosis, cause of death, bill services cost that necessarily should be sent from HISs to SEPAS. If one of these elements is incomplete, no data from a patient record will be sent to SEPAS. Optional data element refers to items, such as patient name, surname, father's name, telephone number and patient's address which are not obligatory. Without these items, other data elements of a patient record are sent to SEPAS.

According to Figure 1, Patients' information is transferred from HIS to SEPAS on each patient encounter.

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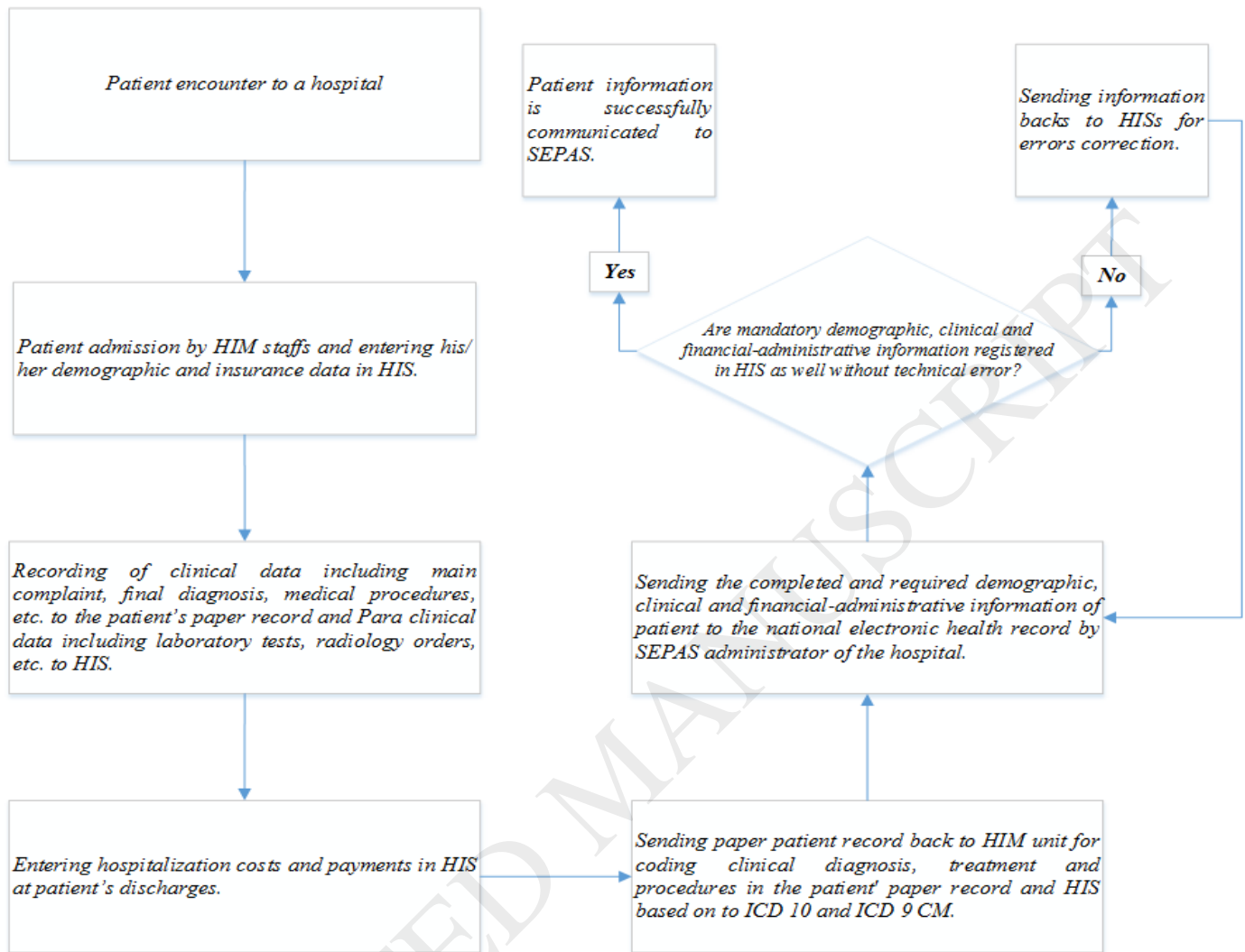
Figure1. Data flow from HIS to SEPAS

Sample size determination

This study was conducted in six hospitals of Kerman University of Medical Sciences, in Kerman province, comprising Afzalipour, Shafa and Beheshti (using Tiraje system), Bahonar and Valiasr (using Payvand Dade system) and Imam Reza (using Rahavard Rayane system). A total number of 6334 records had not been sent to SEPAS during these three months (Bahonar (N=3253), Valiasr (N=1343), Imam Reza (N=691), Shafa (N=613), Afzalipour (N=264) and Beheshti

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(N=170)). The sample size was calculated 882 record and selected from each system and hospital based on proportional allocation (Bahonar (n=455), Valiasr (n=185), Imam Reza (n=96), Shafa (n=86), Afzalipour (n=36) and Beheshti (n=24)). Included records were randomly selected from the list of unsent records in each HIS, with an interval of 7 records.

Data collection

Sample records were extracted from the information communication module of the hospital information systems. Then these patent records were reviewed for documentation errors and for the causes of miscommunication or failure in the communication of patients' information to SEPAS. Data were collected using a data collection form. This form included three columns: errors number, description and the causes of communication failure.

Data analysis

Data were analyzed using SPSS 18. Descriptive statistics were used to calculate frequency and percentage of errors; Chi-square and Fisher's inferential statistics were used to determine the Relationship between the number of errors and the type of hospitals' information systems and to compare the level of information communication of hospitals. In general, the chi-square and fisher's tests were used to check the equality of distribution of variable in different groups. Fisher test was used if statistical conditions were not available for using the chi-square test (more than 20% cells of contingency table had expected frequency less than 5).

Ethics statement

Tis study was approved by the ethical committee of Kerman University of Medical Sciences (approval number **IR.kmu.REC.1394.333).**

Results

Categorization of the errors and causes of communication failures

A total of 1256 errors out of 41 different types were detected in unsent records of which some records had more than one error. We categorized the financial and insurance errors, as well as

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technical errors in the system level errors category, and errors related to users placed as operator-dependent errors. Table 1 shows the frequency and percentage of errors in the unsent records in terms of the type of system level errors and operator-dependent errors. Table 2 also presents the frequency and percentage of errors in the unsent records in terms of information type. Based on the type, we classified errors into four categories. 1) Errors related to the national code including missing codes, invalid codes, "0" in the field of national code and the mismatch between patients' information and their national codes. 2) Clinical information errors including missing codes related to final diagnosis, invalid documentation of final diagnosis and failure to record patient's cause of death. 3) Financial-administrative errors including accounting errors and inconsistencies in the calculation of costs, insurance related errors such as missing patient's insurance number and patients' charges, administrative errors and errors related to patients' admissions. 4) SEPAS-related errors such as an error in health codes related to SEPAS as well as some technical errors such as server problems, SEPAS shut down and other non-technical errors. Financial-administrative errors (61%), national code errors (23%), clinical errors (9%) and other errors (7%) constituted all errors in SEPAS. Moreover, the number of errors related to communication of information from hospital information systems to SEPAS was a significant difference (p <0.0001).

Table 1: Causes of errors in records not communicated from hospital information systems to

SEPAS

Type of Error	Frequency (%)
System level errors	822(65)
Operator-dependent errors	434(35)
Total	1256(100)

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Table 2: Types of errors in records not communicated from hospital information systems to

SEPAS

Type of Error		Hospital					Total	P-Value
	Bahonar Frequency (%)	Valiasr Frequency (%)	Afzalipour Frequency (%)	Shafa Frequency (%)	Beheshti Frequency (%)	Imam Reza Frequency (%)		
National code*	151(52)	41(14)	7(2)	29(10)	14(5)	48(17)	290(23)	<0.0001
Clinical*	1(1)	0	12(11)	63(56)	10(9)	26(23)	112(9)	<0.0001
Financial-Administrative*	433(57)	261(34)	25(3)	16(2)	0	29(4)	764(61)	<0.0001
Other**	17(19)	52(58)	2(2)	1(1)	0	18(20)	90(7)	<0.0001

*Chi-Square   **Fisher

Description of errors in each category

National code errors

Table 3 shows different types of errors associated with patients' national codes. The highest and

lowest incidences of these errors were identified in Bahonar (52%) and Afzalipour (2%) hospitals,

respectively. The number of errors related to the national code was a significant difference in the

studied hospitals (P<0.0001). About 54% of these errors were related to missing national codes.

National codes of 48 patients (5.5%) were documented as zero. This study showed that the national

codes of 30 non-Iranian patients were not documented in Bahonar and Valiasr hospitals (both use

Payvand Dade system). In the reporting module of this system, failures to register national codes

or incorrect codes were known as an error resulting in non-communication of information to

SEPAS.

Table 3: Different types of national code errors in terms of hospitals

		Hospital					Total	

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Type of Error	Bahonar Frequency (%)	Valiasr Frequency (%)	Afzalipour Frequency (%)	Shafa Frequency (%)	Beheshti Frequency (%)	Imam Reza Frequency (%)		P-Value
Missing codes*	66(42)	23(15)	4(2)	19(12)	14(9)	32(20)	158(54)	<0.0001
Invalid codes*	85(75)	13(11)	3(3)	10(9)	0	2(2)	113 (39)	<0.0001
Mismatch between patients' information and their national codes**	0	5(26)	0	0	0	14(74)	19 (7)	<0.0001

*Chi-Square   **Fisher

Clinical information errors

The frequency of different types of clinical information errors is shown in Table 4. The highest and lowest incidences of these errors were observed in Shafa hospital (56%) and Valiasr hospital (0%), respectively. Most of these errors were related to missing final diagnosis (73%). The number of errors related to missing final diagnosis, invalid diagnosis and missing causes of death was a significant difference in the studied hospitals (P <0.0001).

Table 4: Different types of clinical errors in terms of hospitals

Type of Error	Hospital						Total	P-Value
	Bahonar Frequency (%)	Valiasr Frequency (%)	Afzalipour Frequency (%)	Shafa Frequency (%)	Beheshti Frequency (%)	Imam Reza Frequency (%)		
Missing codes related to final diagnosis*	0	0	10(12)	57(70)	10(12)	5(6)	82 (73)	<0.0001
Invalid documentation of final diagnosis**	0	0	0	0	0	2(100)1	21 (19)	<0.0001

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Failure to record patient's cause of death**	0	0	2(25)	6(75)	0	0	8(7)	<0.0001
Patient cause of death is incomplete**	1(100)	0	0	0	0	0	1(1)	1

*Chi-Square   **Fisher

Financial-administrative errors

Table 5 presents the frequency of different types of financial-administrative errors. The highest and lowest incidences of these types of errors were respectively related to Bahonar Hospital (57%) and Beheshti hospital (0%). Also, the number of financial-administrative errors was a significant difference in the studied hospitals (P <0.0001). Among this group of errors, financial information errors (57%) and insurance information errors (39%) had the highest frequency. About 225 (76%) of the insurance information errors were related to missing patients' insurance numbers (77%, 13% and 10% in Bahonar hospital, Valiasr Hospital, and Imam Reza hospital respectively); which resulted in the failure to communicate information to SEPAS. Financial and insurance errors accounted for 89% of the system level errors. These errors are related to the lack of coverage for some clinical and Para-clinical procedures by some insurance centers.

Table 5- Different types of financial-administrative information errors

Type of Error	Hospital						Total	P-Value
	Bahonar Frequency (%)	Valiasr Frequency (%)	Afzalipour Frequency (%)	Shafa Frequency (%)	Beheshti Frequency (%)	Imam Reza Frequency (%)		

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Accounting errors*	228(53)	188(43)	11(3)	5(1)	0	0	432	<0.0001
Administrative errors**	0	1(3)	14(44)	11(34)	0	6(19)	32	1
Insurance errors*	205(69)	72(24)	0	0	0	23(8)	300	<0.0001

*Chi-Square   **Fisher

Approximately 56 (4.5%) of all errors were related to SEPAS settings. These types of errors were related to the system and human factors were not involved.

Discussion

Core-summary findings

In total, more than one-third of the errors detected during the communication of information from hospital information systems to Iranian electronic health record are related to human factors. About two-thirds of all errors are also placed in the category of financial-administrative errors, most of which are related to financial and insurance information errors. Less than one-tenth of the errors resulting in the failure to communicate information from hospital information systems to Iranian electronic health record are clinical data errors, most of which are due to missing final diagnosis. Generally speaking, most errors related to the national code and administrative-financial information errors were identified in Bahonar and Valiasr hospitals (Payvand Dade system), and the most clinical information errors were observed in Shafa Hospital (Tiraje system).

Although the number of errors related to the communication of information between health information systems had a significant difference among the hospitals, it seems that all errors

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(except technical and most financial and insurance errors) such as national code errors, clinical information errors and administrative errors are committed by human, i.e. by users of hospital information systems when registering patient demographics and clinical information and at the time of patients' discharge. Wager[21] pointed to systemic and non-systemic errors such as user errors and random errors including bad handwriting and typing errors as the causes of poor information quality in health information systems.

Comparisons with existing literature

Errors related to national codes were among the errors resulting in the failure to communicate information to SEPAS. More than one-third of these errors were related to incorrect documentation and more than half of them were related to the missing patient national codes. According to researchers' investigations, non-Iranian patients, severely injured and emergency patients, as well as illiterate patients and patients with no identification cards, were those whose national codes and insurance numbers have not been recorded or have been recorded incorrectly. In care institutions, unique identifiers such as national codes or insurance numbers are used to search and retrieve different patients' information.[22] Therefore, careful documentation of these information elements is of great importance. In order to prevent missing or inaccurate recording of national codes, they can be completed through the integration of hospital information systems and the communication of information with information systems of other medical and non-medical centers like National Organization for Civil Registration, insurance companies and forensic medicine. For example, according to a report by the U.S Governmental Accountability Office (GAO) about the use of health information technology in 2007, hospitals and health care centers in the United States were able to collect or validate patients' information through interaction with Medicare and Medicaid institutions.[23] Consistent with the results of this study, Khan[24] identified

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disintegration of health information technologies as one of the barriers and the inter-organizational coordination as an effective measure in the communication of health information. For non-Iranian patients, it is recommended to use their passport number instead of the national code.

Health information management administrators are responsible for assigning the codes to final diagnosis, patient's cause of death and other clinical conditions in Iranian hospitals. About one-tenth of the errors leading to the failure to communicate information to SEPAS were errors related to the documentation of clinical diagnostic codes. The highest rate of clinical information errors was found in Shafa, Imam Reza, Afzalipour and Beheshti hospitals (Tiraje and Rahavard Rayane systems) due to the lack of documentation or incorrect documentation of diagnostic codes. This type of errors is usually committed by operators.

One of the most important factors of failure to communicate patients' information to SEPAS was mistakes or negligence of the users of hospital information systems. According to the World Health Organization, data entry is associated with operator-dependent errors. Hence, it is always emphasized to prevent and correct errors.[25] In the studies conducted by Yackel and Khan,[15, 24] operator-dependent errors and mistakes, as well as users' poor skills and training, were among the factors contributing to failure in the communication of information between systems. Preventing users' errors is one of the most effective factors that improve the communication of information between systems. Systems must be designed in such a way that prevents the occurrence of errors. To reach this, it is expected that the systems provide a message to users after the transition from a critical step to the next step to ascertain their confirmation about the quality of data and provide an alert to users when an error occurs.[26] Users training, motivation and reminding them about the importance of complete, accurate, and timely recording of information such as national code and clinical diagnostic codes can encourage users to pay due attention to

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these messages and can result in complete and correct documentation of information. When operator-dependent errors are persistent, professional actions such as incentive and punishment measures can partly arouse complete and precise documentation of information. In addition, it is recommended that users use information of patients' valid identification cards for data entry to prevent errors and when necessary, ask for the assistance of patients or their companions.

Information system designers should also design the systems in a way that display a warning message about user's mistake in the case of missing entry, incorrect documentation of the national code or clinical diagnostic codes and prevent them from taking the next action or finalizing the task.[26, 27] Errors related to the incorrect documentation of information can be reduced by defining appropriate attributes for data entry fields (such as the type and number of characters for each field). For example, using 10 numeric characters for national code field in Iran reduces the possibility of entering more or fewer characters. Previous studies have shown that interventions such as designing a minimum data set, defining data and their characteristics in a data dictionary, using structured forms and methods for entering data and determining the type and number of characters for information elements can improve the quality of information and its effective exchange.[28, 29] Other measures like automatic checking of information by the system, providing users with information quality assurance reports and continuous controlling of information for completeness increase the quality of information documentation in health information systems.

According to the interviews with IT department staff and hospital information system coordinators, SEPAS has been designed in a way that it is possible to communicate information of non-Iranian patients to SEPAS even if their national codes are not recorded. Despite this, our results showed that the information of a large number of non-Iranian patients was not communicated due to the absence of the national codes in two Bahonar and Valiasr hospitals (using Peyvand Dade system).

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These patients form a part of the society and incomplete information of this group affects their health and the health status of other people, indirectly. This kind of system level errors occurs due to non-compliance with the guidelines issued by the Ministry of Health about designing health information systems. Yackel and Dogac[15, 16] and stated that nonconformity to guidelines and insufficient system test prior to the implementation are among the contributing factors leading to the improper communication of information among systems. As well as previous studies [30, 31] have shown that adherence to standards during the design and implementation of systems can improve the quality of information and reduce errors.

Another error which prevented the records from being communicated from hospital information system to SEPAS in three hospitals (Bahonar, Valiasr, and Imam Reza) was missing patients' insurance numbers. In order to overcome this barrier, patients' insurance numbers should be recorded accurately and controlled carefully at the time of admission and discharge. Moreover, hospital information systems and SEPAS should be connected to insurance systems to receive patients' insurance information from these systems. In addition, since the unified health identifier (UHID), used in health information systems such as EHR, helps improve the accuracy of information and safety of patients using people's biometric information such as fingerprints, iris scanning, face recognition, etc.[32] Thus, after receiving permission from the relevant legal centers about using this technology, it can also be used to improve the quality of information at the time of patients' admission. This technology is especially beneficial for identification of emergency patients and for other patients whose demographic and insurance information is incomplete and admission staffs have no access to their information.

Discrepancies in the calculation of costs and financial and insurance bills are another group of errors that affect the quality of information in hospital information systems, insurance centers, and

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SEPAS. These types of errors often occur when patients' therapeutic procedures and tests are not covered by the insurance organizations. It is suggested that the design of information systems follow the guideline of services covered by the insurance companies and should be aligned with the workflows of the hospitals and other involved organizations.

Based on the results of this study, about 4.5% of the errors resulting in the failure to communicate information to electronic health record were related to SEPAS settings. Similarly, Yackel in a study [15] reported that errors related to EHR settings were among the errors occurred while communicating test results to EHR.

Less than 3% of errors resulting in failure to communicate information were related to technical issues such as server problems and SEPAS system shut down. Vest[33] stated that technical problems such as problems in the network connections, low internet speeds and lack of effective technologies in health information communication were among the possible challenges in this area. Although in this study the number of technical errors was lower than other errors, these types of errors were considered important barriers to the proper exchange of information, requiring prioritized action.[33] Successful implementation of technologies such as electronic health records requires appropriate infrastructures to communicate information among systems. Hence, they should be provided before proceeding toward implementing health information systems.

Assefa[34] showed that the communication and sharing of patients' information could improve providers' relationships and access to patients' information in different health care centers, and subsequently improves the quality of diagnosis educational and therapeutic programs and health outcomes, increases patients and physicians' satisfaction and reduces medical errors. Since EHR is supposed to cover all patients' encounters with different health centers and to contain all clinical

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information, accurate and error-free communication of information to EHR can improve healthcare outcomes.

Correct implementation of electronic health records leads to immediate access and easy communication of patients' information between health care providers and patients.[35] Despite its numerous benefits and advantages, it is an expensive intervention for hospitals and care institutions.[36] However, if it is implemented correctly much of the expenses will be paid off soon. Successful implementation of EHR can boost a hospital's revenue by increasing the number of addmisions due to time efficiency, and reduce cost by decreasing the use of paper and some equipment such as paper file cabinets and printers. The result of a previous study have also indicated that the primary care clinics can realize a positive return on investment with EHR[37].

limitations and future recommendations

This study had one limitation. Among 27 distinct hospital information systems which are used in various hospitals in Iran and sent thousands of hospital records to SEPAS every day, we examined three most commonly used hospital information systems in six main hospitals of Kerman University of Medical Sciences. Further examination of other hospital information systems may result in more generalizable results about all barriers of information communication to EHRs and provide more comprehensive resolutions. However, there are a few studies addressing the errors and causes of failure in the communication of information among health information systems [15, 16, 33]. This study is the first study underpinning errors related to the communication of information from hospital information systems to electronic health record and their causes.

Implications for research and practice

The results of this study provided an insight into the barriers of information communication to authorities and administrators of health information systems, especially of electronic health record.

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In Iran, health information systems especially EHR are relatively new or in the early stages of their advancement. Although these barriers may have been resolved in developed countries, many countries that are recently involved in the implementation of EHR encounter similar problems. The result of this study can help developing countries to prevent errors and failures in the communication of information among health information systems. Based on the results, we specifically recommend that designers of hospital information systems to apply the following adjustments to improve the quality of information and the process of communication among systems: adding functionalities to provide error messages and resolution; creating a data dictionary and defining appropriate attributes for data entry fields; using compulsory fields for necessary information; linking hospital information systems to databases of other centers such as the national organization for civil registration, insurance companies and forensic medicine; and using patients' biometric information to capture their identification and insurance information.

Sending all hospital records' information to EHR results in the integration of all patients' information from different hospitals in one accessible place. As well as the elimination of identified errors in data communication, it leads to increased accuracy and completeness of patient information. Subsequently, high quality information can have a positive effect on patient diagnosis and treatment process. This information can be used for future planning, policymaking and decision makings in the healthcare domain, and for achieving epidemiological goals and conducting clinical research. As it is the case in Iran, failure to communicate information may affects the future funding of hospitals. In Iran, by identifying and removing these errors hospital administrators facilitate allocation of more budgets to their hospitals, according to health reform plan in Iran.

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We recommend that the future studies evaluate the effect of applying the suggested solutions in this study on quality of information communication. Alteration or improvement of work processes such as calculating health care billing cost, detecting and completion of incomplete patient information and clinical codes during care period in hospitals, or applying interventions such as linking health information system to the relevant databases of other organization may reduce problems and errors revealed in this study.

Conclusions

The results of this study revealed that the most important causes for miscommunication of patients' information to EHRs are financial-administrative information errors, national code errors and clinical information errors, respectively. Many of these errors are made by users of information systems due to the failure to record information or recording incorrect information and faulty financial-administrative calculations. The results of this study showed that communication of information in different hospitals using the same hospital information systems might be accompanied by different types and levels of errors. This difference could be due to the differences in users, processes, and services of hospitals. The most distinctive errors are associated with the registration of national codes and clinical information codes or some other administrative processes. Therefore, hospital managers and information system developers should take some measures to prevent these types of operator and organizational errors. Hospital information system providers can also benefit from the results of this study to improve the quality of their products and to promote their position in the healthcare market.

Author Contributions:

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R.Abbasi and R.Khajouei contributed to the conception and design of the study, acquisition and interpretation of the data, and drafting the paper. M.Mirzaei was primarily responsible for the statistical analysis of the data. All 3 authors read and approved the final version of the article submitted.

Conflicts of Interest

The authors declare no conflict of interest.

Summary Points

What was already known on the topic
• Technical and systemic errors imped the complete communication of information among health information systems.   • Miscommunication and partial communication of information between Hospital Information Systems (HIS) and Electronic Health Record (EHR) reduces the quality of information on a nationwide scale.
What this study added to our knowledge
• The same HISs used in different hospitals could face dissimilar types and levels of errors when communicating with other information systems.

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> • Many of the communication errors between health information systems can be prevented by adding new functionalities or modifying current functionalities of these systems.

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