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RESEARCH

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Challenges and solutions in implementing electronic prescribing in Iran's health system: a qualitative study

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Abstract

Background The use of electronic prescribing is recognized as a strategic tool for improving healthcare. Given the nationwide implementation of electronic prescribing systems initiated in 2020, this study aims to explore the challenges and solutions for implementing electronic prescribing in Iran's health system as a developing country.

Methods This qualitative study was conducted through interviews with physicians, pharmacy staff, and electronic prescribing representatives in 2023. Initially, three in-depth interviews were conducted to develop the interview questions, resulting in three separate interview guides for each participant group (supplementary file no.1). Participants were purposively selected, including 12 physicians, 15 electronic prescribing representatives, and 9 pharmacy staff members. Interviews continued until data saturation was reached. The interviews were recorded, transcribed, and analyzed using Inductive content analysis with MAXQDA version 10 software. To identify challenges, sessions were held, and a final list of challenges was categorized. In the final stage, expert panels including 3 researchers, 4 e-prescribing representatives, and 3 insurance experts were formed to propose solutions.

Result The challenges identified in this study were categorized into two main domains: "Organizational Challenges" and "Systemic Challenges." Organizational challenges included issues related to insurance (16 cases), patient referrals (4 cases), stakeholder education and communication (6 cases), and supervision (8 cases). Systemic challenges included infrastructure problems (18 cases), user interface (UI) issues (14 cases), and database issues (10 cases). The primary challenges in implementing electronic prescribing were system downtime and sluggishness, internet connectivity issues, and the existence of multiple insurance systems. Expert panel discussions resulted in proposed solutions, including the uniform design of software by the Ministry of Health, the establishment of an integrated electronic referral system, conducting practical training sessions for physicians, and implementing electronic signatures.

Conclusion Electronic prescribing in Iran is still in its early stages and will inevitably face challenges and problems. Continuous monitoring of electronic prescribing systems is essential to address implementation issues promptly. Issues related to training insurance monitoring the user interface and database infrastructure were challenging. Overall, improvements in infrastructure, integration of insurance systems, implementation of electronic signatures, adherence to electronic prescribing standards, and provision of practical training are recommended.

Keywords Challenges, Electronic Prescribing, Implementation, Interview study, Pharmacy, Physicians, Solutions

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Introduction

Electronic prescribing (e-prescribing) has commonly been a topic of interest among other electronic health solutions for processing health-related data [1] and is considered a crucial component of health information technology infrastructure, improving patient safety, quality, and cost-effectiveness of care [2]. The World Health Organization's (WHO) "Global Patient Safety Action Plan 2021–2030" emphasizes the critical role of digital health solutions, including e-prescribing, in enhancing patient safety. It advocates for the integration of electronic health systems to reduce medication errors, streamline clinical processes, and improve the accuracy and accessibility of patient data. The plan highlights the importance of robust health information systems and calls for the adoption of digital tools that ensure safer care environments through automation, better communication, and decision support systems. In particular, the action plan stresses the need for standardized implementation of electronic prescribing systems to minimize human error in medication management and to foster a culture of safety in healthcare settings globally. It also outlines strategic goals to improve digital literacy among healthcare providers and patients, encouraging countries to invest in and prioritize digital health infrastructure to achieve long-term improvements in patient safety [3].

The use of e-prescribing has been proposed as a significant strategic policy for enhancing healthcare by the Europe Union. The United States and Europe represent the two major markets for e-prescribing systems globally, with Europe being the largest [4]. Leading European countries in e-prescribing include Denmark, Sweden, Norway, Finland, and Iceland, with the world's first e-prescription implemented in Sweden in 1983 [5].

The implementation of e-prescribing systems in healthcare is rapidly expanding, and improvements in both quantity and quality have been demonstrated. However, according to studies, the acceptance and use of e-prescribing do not always proceed smoothly. Therefore, user perspectives are crucial for the success of these systems [6]. A 2019 study in Saudi Arabia found that 61% of physicians believed e-prescribing facilitates drug prescribing and patient detail retrieval [7].

A study in Kuwait highlighted the importance of e-prescribing in improving patient care quality, streamlining workflows, increasing productivity, and reducing medical errors from physicians' perspectives. However, the need for improved system design and infrastructure was also identified as a barrier [8]. A study by the Social Security Organization (SSO) in Iran revealed that most physicians believed the SSO e-prescribing system was highly effective and efficient, improving patient safety and reducing costs. It emphasized the necessity of adequate financial, human, educational, and supportive resources for users [9, 10].

In Iran, the Social Security Organization first introduced e-prescribing in 2015, with a pilot program in Yazd province. The initiative to eliminate prescription booklets in Social Security medical centers commenced that same year [11]. The comprehensive implementation of the e-prescribing project officially began in February 2019 and extended to 235 cities by November 2019. Since 2020, this initiative has been a priority for both the Ministry of Health and the Iranian Health Insurance Organization. In alignment with Clause 17 of the budget law, which mandated the cessation of paper prescriptions starting January 2022, the complete adoption of e-prescribing has been actively pursued. This mandatory shift is designed to integrate information systems, prevent erroneous drug prescriptions, regulate service provision, eliminate insurance overlaps, conserve paper, and ultimately facilitate the full implementation of the family physician's electronic health record system [12].

As with any technology, the outcomes of e-prescribing largely depend on its implementation [2]. Poorly performing e-prescribing systems can negatively impact healthcare delivery. Therefore, healthcare information systems, especially electronic prescribing systems (EPS), must be carefully evaluated to ensure their performance and quality, encouraging use among users and policymakers [5, 13]. Evaluating health information systems is essential to ensure proper functioning and minimize potential errors [14].

Given the mentioned importance of using and implementing e-prescribing systems, this study aims to investigate the challenges and solutions for implementing e-prescribing in Iran's health system as a developing country, to offer solutions for other countries with similar conditions in providing appropriate strategies to advance the country's therapeutic goals.

Methodology

This study is a qualitative cross-sectional descriptive interview study. One-to-one interviews were carried out from April 9 to August 22, 2022 in two phases. A qualitative approach was employed to examine the challenges and solutions in implementing electronic prescribing (e-prescribing). The participants included general and specialist physicians, pharmacy staff, and e-prescribing representatives who used the e-prescribing system in their service delivery. The inclusion criteria were experience with e-prescribing and willingness to participate in the interview.

Justification for the interview method

Given the complex and multifaceted nature of e-prescribing, a qualitative approach was selected to capture in-depth insights into the experiences and perspectives of healthcare professionals. Interviews were deemed the most appropriate data collection method, as they facilitate a detailed exploration of individual perceptions, challenges, and beliefs regarding the implementation of the e-prescribing system [15].

The semi-structured format allowed for flexibility, enabling the interviewer to probe further into areas of particular interest or relevance to the participants' experiences.

Pilot interviews and development of interview questions

Prior to conducting the main interviews, three unstructured pilot interviews were held with physicians and e-prescribing representatives to refine the interview guide. These preliminary interviews informed the development of a set of questions that were both comprehensive and targeted to the study's objectives. Following iterative discussions among the research team, the interview protocol was finalized. A total of 18 semi-structured questions were developed for physicians, and 7 questions were prepared for both pharmacy staff and e-prescribing representatives. These questions were designed to elicit detailed responses regarding the challenges in e-prescribing implementation and potential strategies for improvement.

Interview procedure and participant recruitment

The primary researcher, who had prior experience as both a staff member and an e-prescribing representative, conducted all the interviews personally. Participants were contacted via telephone to schedule interviews at their convenience. Interviews were conducted in quiet, private spaces at participants' workplaces, typically lasting between 20 and 30 min, ensuring an environment conducive to focused discussion.

At the beginning of each interview, participants were provided with an overview of the study's aims, the expected duration of the interview, and the conditions under which their data would be used. Informed consent was obtained for the recording of the interviews, and participants were assured of the confidentiality of their responses and their right to withdraw from the study at any time without consequence.

Data collection process

Interviews commenced with the collection of basic demographic information to establish rapport, followed by open-ended and semi-structured questions designed to explore participants' experiences with the e-prescribing system. The flexibility of the semi-structured format allowed the interviewer to adapt questions as needed, encouraging participants to elaborate on specific challenges or solutions they deemed important. A total of 36 interviews were conducted, consisting of 12 interviews with physicians, 15 with e-prescribing representatives, and 9 with pharmacy staff. Interviews continued until thematic saturation was reached, ensuring comprehensive coverage of the research topic.

Data analysis

All interviews were audio-recorded, transcribed verbatim, and analyzed using MAXQDA software. Data analysis was performed through a structured coding process, which was conducted in five sessions by three researchers to ensure consistency and rigor. The coding process began with open coding, where initial codes were generated based on recurring themes and patterns observed in the data. These initial codes were then reviewed and refined through iterative discussions among the research team, ensuring that the codes accurately reflected the content of the interviews. Any ambiguities were resolved by revisiting the original transcripts. Once refined, the codes were grouped into broader categories, allowing for the identification of key challenges related to e-prescribing. These categories were further analyzed to extract the most significant themes for further examination.

Trustworthiness and validation of the findings

To ensure the trustworthiness of the findings, Guba and Lincoln's criteria for qualitative research were applied, including credibility, confirmability, dependability, and transferability. Credibility was enhanced by presenting the preliminary results to researchers with expertise in similar studies, allowing for external feedback and validation. Confirmability was established by sharing samples of the coded interview data with a subset of participants, who provided feedback on the accuracy of the analysis. Transferability was ensured through the careful selection of participants with direct experience in e-prescribing and by promptly collecting and analyzing the data. In terms of transparency, all steps in the data collection and analysis process were meticulously documented, and decisions made during the coding and categorization phases were recorded to ensure clarity and accountability. This documentation, alongside the sharing of data excerpts, was intended to provide a clear audit trail, allowing others to trace and verify the research process.

Phase two: expert panel for solution development

In the second phase of the study, an expert panel was convened to propose solutions to the identified challenges.

The panel included three researchers, four e-prescribing representatives, and three insurance experts. The session commenced with an introduction by the researchers, followed by a presentation of the challenges identified in the interviews. A focused group discussion ensued, in which participants contributed suggestions for improving the e-prescribing system. The session was audio-recorded with the participants' consent, and the data were transcribed and analyzed to extract proposed solutions.

In this study, a combination of semi-structured individual interviews and focus group interviews was employed to gather comprehensive qualitative data. Semi-structured interviews were conducted with physicians, pharmacy staff, and e-prescribing representatives to capture their personal experiences and insights on the challenges of implementing e-prescribing. In the second phase, a focus group interview was used to gather expert input and propose solutions to the identified challenges.

The preference for using a focus group interview in this phase was justified by its ability to generate diverse perspectives through group interaction, fostering a collaborative environment where participants can build upon each other's ideas (Morgan, 1996). Focus groups are particularly effective when exploring solutions to complex issues, as they encourage dynamic discussion and the generation of a broader range of ideas compared to individual interviews (Kitzinger, 1995). This method enabled participants, including e-prescribing representatives, researchers, and insurance experts, to collectively discuss and refine potential strategies for improving the e-prescribing system [16, 17].

Results

In this study, 12 physicians, 9 pharmacy staff members, and 15 e-prescribing representatives participated. The e-prescribing representatives included individuals directly involved in the e-prescribing system who were willing to participate in the interviews. Among the 36 people participating in the interviews, 50% were men.The

Table 1 Demographic characteristics of study participants

Interviewing groups		**Physician**	**Pharmacy**	**Prescription Representative**	**Total**
Demographic characteristics		**n (%)**	**n (%)**	**n (%)**	**n (%)**
Sex	female	4(33.3)	4 (44.4)	10 (66.6)	18 (50)
	male	8 (66.6)	5 (55.5)	5 (33.3)	18 (50)
Age	21–30	4 (33.3)	2 (22.2)	1 (6.6)	7 (19.4)
	31–40	6 (50)	4 (44.4)	11 (73.3)	21 (58.33)
	41 ≤ …	2 (16.6)	3 (33.3)	3 (20)	8 (22.2)
Education	Diploma	0 (0)	1 (11.1)	0 (0)	1 (2.7)
	BA[a]	0 (0)	4 (44.4)	7 (46.6)	11 (30.5)
	MA[b]	0 (0)	0 (0)	8 (53.3)	8 (22.2)
	GP[c]	5 (41.6)	4 (44.4)	0 (0)	9 (25)
	Specialist	7 (58.3)	0 (0)	0 (0)	7 (19.4)
Work experience (year)	1–5	8 (66.6)	2 (22.2)	2 (13.3)	12 (33.3)
	6–10	2 (16.6)	2 (22.2)	3 (20)	7 (19.4)
	11 ≤ …	2 (16.6)	5 (55.5)	10 (66.6)	17 (47.2)
Experience with electronic prescribing (month)	… ≤ 6	4 (33.3)	3 (33.3)	0 (0)	7 (19.4)
	6- 12	7 (58.3)	3 (33.3)	15 (100)	25 (69.4)
	12 ≤ …	1 (8.3)	3 (33.3)	0 (0)	4 (11.1)
Organizational Position	GP	5 (41.6)	0 (0)	0 (0)	5 (13.8)
	Specialist	7 (58.3)	0 (0)	0 (0)	7 (19.4)
	Pharmacy technician	0 (0)	4 (44.4)	0 (0)	4 (11.1)
	pharmacist	0 (0)	5 (55.5)	0(0)	5 (13.8)
	Health information technology expert	0 (0)	0 (0)	3 (20)	3 (8.3)
	Expert in charge of health information technology	0 (0)	0 (0)	12 (80)	(33.3)

[a] Bachelor of Arts

[b] Master of Arts

[c] General Practitioner

demographic characteristics of the participants are presented in Table 1.

The challenges in implementing electronic prescribing, extracted using MAXQDA version 10 software, are categorized into three main categories, subcategories, and codes from the perspectives of physicians, pharmacy staff, and e-prescribing representatives. These challenges are presented in the Table 2.

The table, based on interviews conducted with 12 physicians, 9 pharmacy staff members, and 15 e-prescribing representatives working at Mashhad University of Medical Sciences, encompasses 2 main categories and 7 subcategories (Table 3).

Main Concept: Organizational Domain

1-1) Insurance-Related Challenges: All participants highlighted the existence of multiple insurance platforms as a significant issue

"It was decided that all insurances would use a common platform for prescribing to avoid issues with inquiries and registration. Unfortunately, each insurance currently has its own separate system, each with its own set of problems, and there is no comprehensive, integrated system that we can work with" (Participant 1).

Given that e-prescribing systems initially faced numerous challenges and required several adjustments over time, insurance organizations performed poorly in managing these changes effectively.

"There is no adequate response or support for technical deficiencies in the system. The system's electronic deficiencies are occasionally supported, albeit very weakly. However, in terms of scientific support for issues like the unavailability of drugs or services, I have yet to receive any satisfactory support" (Participant 5).

1-2) Challenges Related to Patient Referrals:

Several participants expressed concerns about the lack of referral codes at the time of patient discharge from inpatient wards, citing an absence of clear mechanisms for referrals. Despite the transition to e-prescribing, some participants mentioned that the referral process still involved paperwork. "The patient referral process should be integrated with other levels of electronic health insurance to eliminate paper-based referrals entirely" (Participant 8).

1-3) Challenges Related to Stakeholder Education and Information:

Many participants indicated that there was insufficient training when the e-prescribing process was initiated. Issues included physicians' lack of awareness about the prescription limits for certain medications and the inaccessibility of patients' medical and drug histories. "I received no training at the start of e-prescribing; I had to learn everything through trial and error and my own research. There were no recommendations or guidance provided" (Participant 5).

1-4) Challenges Related to Supervision:

Several participants noted that some physicians delegated the e-prescribing process to their assistants, making it difficult to supervise the medications dispensed to patients. Additionally, some physicians expressed concerns about the security and confidentiality of the e-prescribing system. "When we want to view a patient's previous records, a confirmation code must be sent, which can cause issues if the patient doesn't have their phone with them. We need to access these records in the patient's presence for their benefit, not to misuse their medical history" (Participant 4).

Main Concept 2: Systemic Domain

2-1) Infrastructure Challenges:

The most frequently mentioned infrastructure issues were system downtimes and internet slowdowns. All participants highlighted these problems. "System downtimes and slow internet are our biggest issues. When a patient comes to the pharmacy, we can't access their prescription or dispense their medication" (Participant 7).

Due to disruptions with mobile operators like MCI and Irancell, and occasional incorrect registration of physicians' phone numbers in the system, one-time passwords (OTPs) were not always received by physicians. Several interviewees mentioned: "Physicians sometimes forget their OTP, or their phone isn't with them, or the OTP is sent to a different number. This causes significant delays until the issue is resolved by colleagues in different locations" (Participant 10).

2-2) User Interface Challenges:

One issue was the lack of a consistent language for searching drugs and services within the e-prescribing systems. Some medications required additional explanations from the physician to the pharmacy staff to prevent confusion, which was not always possible. Physicians found it difficult to search for medications and services due to spelling errors, differing codes, and the abundance of drugs and services. "Finding the names of some tests is very difficult because many tests have similar names, and it opens a long list. In a busy emergency room, it's challenging for a tired physician to avoid making mistakes" (Participant 3).

Another problem highlighted by pharmacy staff was the incorrect entry of usage instructions by physicians. "Some physicians have their assistants enter prescriptions, leading to errors in drug entries and often incorrect

Table 2 Challenges in implementing electronic prescriptions from the participants' perspective

Themes	Sub Themes	Codes
Organizing Field	Challenges Related to Insurance	Weakness of insurance in terms of informing about changes in systems and instructions
		Lack of insurance coverage for some necessary tests
		Multiple systems for insurance
		The lack of an effective communication channel between Physician and insurance experts
		Lack of link between supplementary insurances and basic insurances and the requirement to provide a paper copy of supplementary insurance
		Lack of access to the rules of the electronic version
		Emphasis of insurance companies on not accepting paper prescription
		The need to submit a paper copy to supplementary insurance
		The need to approve some medicinal???? item
		Limited access of electronic prescribing representatives to insurance systems
		Incomplete reporting of insurance systems
		Creation of multiple plugins by the insurance organization
		Non-acceptance of paper prescriptions by pharmacies
		The need to physically send Physician documents to the insurance organization
	Challenges related to patient referrals	Absence of reference code at the time of drug prescription at the time of discharge of patients from hospital wards
		Absence of a specific mechanism in the field of referral
		The referral process is not electronic
		Submission of incorrect and illegible referral code by the patient
	Challenges related to training and informing stakeholders	Lack of knowledge of Physician about expense deductions and bills
		Failure to inform Physicians and patients about the ceiling of medicines and services
		Lack of sufficient training of beneficiaries for electronic prescribing
		Patients are not aware of the referral system
		Failure to inform patients and Physicians about the ceiling of medicines and services
		Not informing patients how to get medicine from the pharmacy
		Failure of Physicians to know the correct code of drugs
	Monitoring Challenges	Inability to guarantee the registration of prescriptions by Physicians
		Lack of supervision over drugs dispensed from pharmacies
		Security issues and misuse of the electronic prescription system
		Problems accessing patient records
		Non-uniform pricing of drugs and other services across different systems
		Lack of use of electronic signatures
		Inability to monitor incorrect prescription registration by Physicians
		Lack of precision and sufficient mastery by Physicians when selecting drugs
System Field	Infrastructure Challenges	Inability to record prescriptions with a mobile phone
		Time-consuming electronic prescribing in busy emergency and clinic environments (lack of human resources)
		No designated individuals for 24-h troubleshooting and system error handling
		Lack of necessary guidelines for prescribing during system or internet outages or slowdowns
		Absence of standardized codes for drugs and other services in the systems
		Issues with recording commercial drugs
		Delays in resolving some system defects
		Failure to send second authentication code SMS
		Incomplete display of alerts when necessary
		Prescriptions not displayed in the pharmacy due to data system slowdowns

Table 2 (continued)

Themes	Sub Themes	Codes
		System and internet outages and slowdowns
		Presence of unspecified system errors
		Lack of an effective communication channel between pharmacy, Physician, and insurance expert
		Some Physician' unfamiliarity and lack of access to electronic prescriptions
		Issues with Physician registration in insurance systems
		Lack of integration between insurance systems and HIS (Hospital Information System)
		Eligibility check discrepancies in different systems
		Lack of integration between insurance systems and the comprehensive physician database
	User Interface challenges	Inconsistent language used when recording drugs and services
		Inability to renew prescriptions
		Inability to record notes for certain medications when necessary
		Multiple usernames and passwords for different systems
		Difficulty in searching for drugs and para clinical services
		Multiple entries for different services in a single prescription
		Separate recording of prescriptions based on the physician's place of practice
		Inability to view tracking codes in the prescription list
		Failure to display frequently used prescriptions alphabetically
		Inability to edit prescriptions
		System interface not designed according to each specialty
		Ability to view the names of scheduled patients in specialized clinics
		Incorrect medication instructions recorded by Physician
		Lack of alphabetical search options
	Database Challenges	Lack of integration between laboratory and radiology results in the systems
		Incomplete family Physician database
		Missing certain drug, laboratory, and radiology codes
		Inability to record compound, herbal, and supplement medication
		Spelling errors in the systems
		Incomplete definition of drug dosages
		Mismatch between patient national ID and prescription
		Undefined certain medications
		Inability to change medication instructions
		Inability to view prescriptions when the tracking code is lost

Table 3 Recommended solutions in the expert panel

Challenge	Existing Solutions and Required Notifications	Proposed Solutions
Weakness of insurance companies in informing about changes in systems and guidelines	Conducting notifications through prescription websites	
Multiple systems for insurance companies		Designing standardized software by the Ministry of Health
Absence of referral codes when prescribing medications at the time of patient discharge from hospital departments	The possibility for emergency users to write electronic prescriptions for rural insurance without referral codes at the time of patient discharge	
Security issues and misuse of the electronic prescription system		The necessity of implementing electronic signatures
Inability to ensure that prescriptions are registered by Physician	Tracking prescription violations via the insurance dashboard	
Inconsistent pricing of drugs and other services across different systems	The commercial nature of drugs as the reason for their price differences	More detailed segregation of actions in the systems
Missing codes for certain drugs, tests, and radiology services		The need for collaboration between the Food and Drug Administration and Physician regarding the design of the drug source in the systems
Lack of an effective communication channel between pharmacy, Physician, and insurance expert		Enabling chat access for communication between Physician and pharmacies/ the necessity for the Ministry to issue guidelines for a unified messaging system for notifying Physician
Inability to record prescriptions with a mobile phone	Capability to register prescriptions via mobile phone	The ability to record prescriptions with a mobile phone enhances the flexibility and efficiency of healthcare providers, improving the overall effectiveness of the healthcare system
No designated individuals for 24-h troubleshooting and system error handling	24/7 national support available through phone number 1666 for health insurance and 1420 for social security insurance	Having designated individuals for 24-h troubleshooting and system error handling ensures continuous support and minimizes downtime, enhancing the reliability and efficiency of healthcare services
Failure to send second authentication code SMS	Creation of OTP codes for second login password to the system	Having the ability to successfully send a second authentication code via SMS ensures secure and reliable access to healthcare systems, thereby protecting sensitive patient information
Inability to edit prescriptions	The ability to edit prescriptions up to 72 h before the medication is collected from the pharmacy	The ability to edit prescriptions allows healthcare providers to make necessary adjustments to treatment plans, ensuring accuracy and improving patient outcomes
Inability to view tracking codes in the prescription list	The ability for patients to view tracking codes in the insurance system	
Necessity for approval of certain drug items	Creating a medical record for the first visit to approve drug items	
Patients and Physician not being informed about the limit on drugs and services	Displaying the list of insured drugs on the mdp.ihio.gov.ir system	Designing systems with short and comprehensible addresses for patients to access and view prescriptions
Lack of linkage between supplementary insurance and basic insurance, and the requirement for paper prescriptions for supplementary insurance		Creating web services for supplementary insurance
Lack of oversight on medications delivered from the pharmacy	The necessity for direct cooperation and continuous interaction with Physician, and following up with Physician/ using patient identification cards for medication delivery	Providing a platform for consultation with the responsible pharmacist or treating physician in the electronic prescription system

Table 3 (continued)

Challenge	Existing Solutions and Required Notifications	Proposed Solutions
Inconsistent language used when recording drugs and services		Correct prescription registration during residency and internship periods
Issues with recording commercial drugs	The ability to deliver commercial drugs when prescribing medication generically	
Non-electronic referral process		Eliminating paper forms in the referral system with user interfaces and adding a series of APIs and web services

usage instructions, like prescribing everything as 'once daily'" (Participant 8).

2-3) Database Challenges:

Physicians reported issues with spelling errors in the system and the absence of some drug codes. "Some drugs are incorrectly named in the insurance system; for example, 'cephalexin' is correctly spelled as 'cephalexin,' but in the system, it is entered as 'cephalexin'" (Participant 9).

Pharmacy staff mentioned that some drugs did not have codes, or only one code was assigned to a drug from various pharmaceutical companies, requiring the physician to write the prescription on paper. "Not all codes are registered in the systems, like some herbal syrups, supplements, etc., so the physician must write these separately on a paper alongside the e-prescription" (Participant 6).

Proposed Solutions in the Expert Panel:

In this phase experts point out various challenges in the management of healthcare systems, focusing on those linked to insurance systems, e-prescription, and communication between healthcare providers. Key suggested solutions to identified challenges include:

- Standardization and System Design: To that effect, standardization of software systems by means of a design from the Ministry of Health is proposed to establish a unified system to overcome this multiplicity.
- Electronic Prescription Management: It is suggested that this will be accompanied by the introduction of electronic signatures in order to increase the security level, as well as the ability to edit prescriptions up until 72 h before the collection of the medication to improve treatment accuracy.
- Establish a Communication Improvement: The introduction of a chatting system among the doctors, pharmacies, and insurance specialists will help improve the communication between participants. Secondly, systems should be developed to include short simple-to-understand web addresses for patients' prescriptions, thus increasing accessibility.
- Mobile Access and Support: This is given to ensure that the user can register prescriptions even through mobile phones for flexibility in whatever the situation warrants, along with 24/7 support to resolve any problem at all for continuous service.
- Insurance Integration: Development of web services for supplementary and basic insurance systems must be established so that dependency on paper prescription can be avoided.

These solutions will be designed to fulfill healthcare management needs, enhance the system's reliability, and ensure both the patient and the provider have an improved experience.

Discussion

This study is a qualitative research aimed at examining the challenges of implementing an electronic prescription system in hospitals affiliated with Mashhad University of Medical Sciences. Based on One-to-one interviews conducted with three groups: physicians, pharmacy staff, and electronic prescription representatives, the challenges of implementing electronic prescriptions were categorized into two main groups: "organizational" and "systemic." Subcategories included "insurance-related challenges," "referral system," "supervision," "infrastructure," "user interface," and "database." Solutions proposed included "designing unified software by the Ministry of Health," "creating systems with short and comprehensible addresses for patients to access their prescriptions," "establishing web services for supplementary insurance," "providing a platform for consultation with the pharmacist or treating physician within the electronic prescription system," "correctly registering prescriptions during residency and internship," and "eliminating paper forms for the referral system by adding user interfaces and a series of APIs and web services."

Studies in Turkey, Finland, and the USA have Similar to this study emphasized the lack of integration between insurance systems and institutions [18–20]. Also In the study by Zamzam Kalume et al. [21], challenges in the paper-based referral system included delays in the referral process and incomplete paper-based referral forms [21]. Craxford et al. found that training new physicians in the use of electronic prescriptions reduces errors and speeds up the process [22]. Like this study, Grossman and Odukoya OK emphasized the need for more training programs for prescribers to improve their skills and reduce the risk of medication errors [23, 24].

Another challenge highlighted in this study was related to supervision, including the inability to monitor incorrect prescriptions by physicians. In the study by RUPP and WARHOLAK, similar to this study, the need for pharmacist intervention was discussed to address issues in the electronic prescription process and incorrect medication or instructions from Physician' offices [25]. In a study by Luiz Antonio in Brazil, similar to this study, data security and patient privacy were crucial concerns for electronic prescription systems, with fears of hacker intrusion and system insecurity causing significant worry among users [26]. Other studies in Turkey, Kuwait, South Africa, and Brazil also reported better performance by physicians in using electronic signatures [8, 26–28].

The most frequently discussed challenge in this study was related to infrastructure, with almost all participants mentioning this issue. In the study by Abdulsalam M. Matuq and Almutairi, a lack of technical support and maintenance was also noted [8, 29]. Sinan Bulut et al. similar to this study reported that more than a quarter (26.5%) of family physicians complained about system slowdowns, system outages, and internet-related problems [18]. In Eija Kivekäs's study in Finland, physicians stated that weaknesses in telecommunications networks led to uncertainty about receiving electronic prescriptions [19].

One of the identified requirements in this study was an appropriate user interface. Findings by Myler and Sinan Bulut also emphasized the need for a suitable user interface for prescribing medications, which should have adequate, recognizable, and editable inputs [18, 30]. The importance of users finding and selecting drug names, completing various prescription fields, and creating a customized set of medications has been highlighted in various studies [31, 32].

A challenge mentioned in this study was related to the database. Other Studies have emphasized the use of standard and common terminology among prescribers and implementers to avoid different interpretations and consequently reduce errors related to patient safety [33, 34]. In Saudi Arabia and Lebanon, similar to this study,the lack of drug lists in the system affected physicians' willingness and ability to use electronic prescriptions [7, 29]. One of the problems in the present study was the absence of some drug codes, which was also reported in the study by Zadeh PE, where the absence of some drug names, dosages, or diagnoses in the system and the inability to prescribe them were issues [35]. Medication errors (both repetitive and omitted), prescription routes, frequencies, and dosages (both overuse and underuse) were among the most common electronic prescription errors. Additionally, the lack of a standardized electronic prescription format was one of the most frequently reported issues [35, 36].

Based on the results of this study, there are more research needs to investigate the level of awareness and perception of patients and other users regarding the implementation of electronic prescribing.

The limitations of the present study include the small number of participants and the lack of access to more physicians, who are the primary users of electronic prescribing systems. One of the strengths of this study was that it was conducted at the beginning of the implementation of the electronic prescription system, which had many challenges and also the use of the original excerpts was in the implementation of this plan.

Conclusion

The electronic prescription system is complex, influenced by various stakeholders. This study identifies the challenges and proposes solutions for successful implementation. Addressing infrastructure, insurance, and monitoring issues, while considering stakeholders' expectations, is vital for the system's success. Continuous monitoring and immediate application of findings, along with practical training and standardization, are recommended for improvement.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12911-024-02737-3.

Supplementary Material 1.

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Authors' contributions
Study concept and design: Borhani and Meraji. Analysis and interpretation of data: Hooshmand, Drafting of the manuscript: Borhani. Critical revision of the manuscript for important intellectual content: Zarqi, Meraji. All authors read and approved the final manuscript.

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Data availability
Data that support the findings of this study have been are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
This research is approved by Ethics Committee of Mashhad University of Medical Sciences (IR.MUMS.FHMPM.REC.1400.073) informed consent to participate was obtained from all of the participants in the study.

Consent for publication
The authors declare their Consent for publication.

Competing interests
The authors declare no competing interests.

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