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Research Article

Challenges of Implementing Electronic Prescribing in a Low-Income Country: A Qualitative Study

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Abstract

Background: Electronic prescribing (E-prescribing) is a novel digital tool that can provide a complete patient profile and further helps to avoid prescription errors.

Objectives: In this study, we aimed to evaluate the present state of E-prescribing in Iran, identify its process, and diagnose its software flaws.

Methods: Semi-structured interviews with several user groups, health system executives, and patients were conducted for this qualitative study (concluded in 2022), and MAXQDA 11 software was used for coding and data management.

Results: According to our interviews, the challenges of the E-prescribing process include a lack of appropriate culture, support for service providers, and physician cooperation; poor management; frequent system interruptions; extra workload imposed on pharmacies; and a failure to adapt systems for underprivileged areas. Moreover, the software themselves have a number of flaws, notably inconsistent and missing medical codes, their inability to keep up with an increase in the workload, difficulty in connecting some older systems with the latest ones, and a lack of a user-friendly interface.

Conclusions: Despite the continual improvements in the E-prescribing system, its further effective implementation in our country requires ongoing interaction with all stakeholders, enlisting their opinions, and resolving its problems as quickly as feasible.

Keywords: E-Prescribing; E-Prescription; Prescriber; Pharmacies; Patients; Weaknesses

1. Background

The invention of information technologies has had a significant impact on a variety of enterprises. Their specialty is the simultaneous enhancement of quality and reduction of expenses, and healthcare facilities were not exempt from their impact (1, 2). Since these settings tend to generate a large amount of data that needs to be gathered, distributed, recorded, retrieved, and summarized, these innovations have been quite beneficial for them. Electronic medical data registration and electronic health systems (E-Health) are two examples of how such technologies are being integrated into the Iranian healthcare system (3). The E-Health is a relatively novel system that includes remote patient monitoring, electronic consultation, remote learning, and electronic prescribing (E-prescribing), among others (4). Furthermore, properly used technology helps healthcare providers reduce medical errors and improve service standards. One such technology is the E-prescribing platform (5). The E-prescribing platform is an internet-based software that provides physicians with online access to information, warnings, complete patient profiles, and decision support systems, assisting them in issuing medical prescriptions and avoiding errors (6, 7). Through E-prescription systems, the issued prescription is immediately and directly sent from the physician's computer to the pharmacy's computer, reducing prescription errors (and the need for corrections), speeding up the process, and boosting patient satisfaction (8-10). According to international literature, such technologies should include features like faxing prescriptions or online communications, medical and/or pharmaceutical decision support systems, and patient information systems (such as electronic health records) (11, 12).

Studies show that countries have different approaches

to implementing and utilizing this process, and the reason for this is the difference in their health and insurance systems. Therefore, each country is at a different level of implementing an E-prescribing program. The E-prescribing laws have been passed in the United States (13), England (14), and Finland (15). However, in Sweden (6) and Denmark (16), due to the issue of patient information confidentiality and the inability to use electronic signatures, there is no legal enactment for the use of E-prescribing. Sweden (17), the United States (18), and England (19) have centers for eHealth governance that are responsible for coordinating health information technology at the national level, but most countries don't have such integrated governance. However, one thing that is common to many countries is that financial investment for the implementation of E-prescribing is provided by the government and from public sources.

In Iran, electronically exchanging health data originated in information exchanges in laboratory departments using floppy disks (primarily for reprinting the results of biochemical tests) and gradually extended to radiology departments' services (20). But the first significant development that signaled the steadfastness of the oncoming change in Iran was the approval of computerized laboratory bills by the Medical Services Insurance Organization (the current Iranian Health Insurance Organization) during the early nineties (21). The "New System of the Administration of the Hospitals" plan was then made publicly available to all medical universities in 1993, and it had a considerable impact on the expansion, creation, and adoption of computerized systems in the Iranian healthcare landscape. During the mid-2000s, and with a wavering commitment, the Ministry of Health and Medical Education (MOHME) had already started to introduce E-prescribing into the healthcare system, but it wasn't until 2020 when the national determination ultimately came, and the full integration of E-prescribing became their top agenda, making issuing and filling out prescriptions using only E-prescribing software a national standard (22).

2. Objectives

Given that E-prescribing is a relatively novel system for many healthcare facilities, identifying its inadequacies is a vital step for the successful continuation of its national use. Thus, in this study, we aimed to identify and categorize the weaknesses of software and E-prescribing processes to help developers remove any defects and aid in its further integration.

3. Methods

In the second half of 2022, semi-structured interviews with patients, users of E-prescribing, as well as some health executives were conducted to collect information for this qualitative research. Three interview guides, developed based on published studies and the input of three professionals in the E-prescribing field, were employed as a data-gathering tool for the interviews. It should be emphasized that the validity of the interview guides was ensured through experts' verifications and two pilot interviews (two experts and two patients, who were not included in our sample), which resulted in minor revisions and finalization. The finalized interview guide included two sections: Questions concerning age, gender, organizational position, employment history, and other personal characteristics; and questions on the current condition, defects, and capabilities of the E-prescribing software. The interview included a few spontaneous questions as well as a number of fundamental questions with no specific predetermined structure to eliminate the possibility of interviewer bias (23). The interviewees chose the date and place for their in-person interviews. Patients, pharmacists (from pharmacies that used E-prescribing software), physicians, software engineers, and a number of associated healthcare executives were interviewed. Eighteen interviews in total were completed (Table 1). Key informants who were experienced with E-prescribing were chosen through purposeful sampling (24). To interview patients (who had purchased medicine through the E-prescribing software), three pharmacies in the west, east, and center of Tehran were visited.

Table 1. The Number and Organization of Interviewees

Organization/Individual	Number of Interviewees
MOHME	3
Laboratory	2
Pharmacy	2
Social health insurance	2
Physician	3
Patient	6
Total	18

[z] Abbreviation: MOHME, Ministry of Health and Medical Education.

The interview participants were given a brief introduction to the research and were informed of how their disclosed data would be anonymized, utilized, and to whom it would be accessible. Their interviews commenced only after their verbal consent was obtained (25). Interviews continued until data saturation was reached; notes were taken during each interview, and all were recorded. Based on Graneheim and Lundman's method, the content analysis approach was used for data analysis. Graneheim and Lundman's five steps are as follows (26):

1. Transcription: Implementing the interviews' texts.
2. Meaning units: Reading the interviews to gain a general understanding.
3. Abstraction: Determining the meaning units and initial codes (the condensed meaning units are abstracted and labeled with a code).
4. Sorting the codes: Classifying similar initial codes

into more comprehensive and general categories.

5. Theme formulation: Introducing the categories' main themes.

After the initial coding, each code was thematically compared to all others, and the codes that specifically referred to similar ideas were grouped as sub-themes. This process was repeated multiple times. The final themes were revised and verified once more with the data to confirm their reliability. The codes were handled and organized using MAXQDA 11 software.

At the final stage, the four criteria established by Lincoln and Guba — acceptability, generalizability, similarity, and verifiability — were used to evaluate the integrity and validity of the research. The four criteria for naturalistic research have been linked and paired with the standard quantitative research criteria, and Lincoln and Guba have provided strategies to assure the quality of each criterion (27).

4. Results

This study sought to identify the shortcomings and deficiencies within both the software and procedural aspects of Iran's E-prescribing system. Analysis of interview data revealed two overarching themes: (1) Implementation challenges (eight subthemes) and (2) software-related challenges (four subthemes). The subthemes for each category are outlined below (Table 2).

Table 2. Themes and Sub-themes

Themes	Sub-themes
Challenges in E-prescribing implementation	Physician's inadequate training
	Poor execution by the MOHME
	Diversity in software adopted by basic insurance companies
	Physicians' unwillingness to collaborate
	Health insurers' insufficient assistance in providing computer hardware and software
	Inadequate and unstable Internet connection
	Increased workload for pharmacies
	Failing to take into account the unique peculiarities of deprived provinces
E-prescribing software challenges	Coding
	Missing codes for some medicines
	Lack of a unified standard for coding services and medicine across software
	Low user-friendliness of the existing system interface

[z] Abbreviations: E-prescribing, electronic prescribing; MOHME, Ministry of Health and Medical Education.

4.1 Challenges in Electronic Prescribing Implementation

4.1.1. Inadequate Training of Physicians

A predominant view among interviewees was that insufficient preparatory training for physicians constituted a major barrier to the timely and effective implementation of the E-prescribing program. Participants noted that, prior to making E-prescribing a mandatory standard, there had been little investment in structured educational initiatives to build the necessary knowledge base and foster an appropriate professional culture. As one policymaker observed: "We imposed a compulsory system on some of the most capable members of society without providing them with adequate training. I believe that even a single online training session could have resolved many of the challenges they face in using E-prescribing."

4.1.2. Poor Execution by the Ministry of Health and Medical Education

Several interviewees identified the weak operational role of the MOHME as a critical shortcoming in the implementation of the E-prescribing program. Participants frequently noted that the dominant administrative and supervisory role assumed by insurance organizations had further underscored MOHME's limited engagement. As one administrator explained: "Currently, platforms for electronic prescriptions are provided by insurance companies, and the MOHME has not developed any specific platforms. This organization's conflict of interest could be at the root of the problem."

In addition, some respondents argued that MOHME had lost sight of the core objective — standardizing the E-prescribing system — thereby diminishing its oversight function. As one physician remarked: "I believe that one of the difficulties with prescription is that the Ministry of Health has lost its supervisory role on E-prescribing and, as a result, over time, the planned prescription program has been neglected."

Other participants attributed this lack of focus to frequent managerial changes within MOHME, which disrupted continuity and prevented long-term planning.

They also highlighted the absence of a comprehensive vision and a documented roadmap, noting that short-term, ad hoc approaches have significantly hindered the program's effective and consistent implementation over recent years.

4.1.3. Diversity in Software Adopted by Basic Insurance Companies

Interview findings revealed that the existence of multiple, non-uniform E-prescribing software platforms — developed and implemented separately by various health insurance and social security organizations — has contributed to considerable confusion and dissatisfaction among system users, including physicians, pharmacists, and other healthcare providers. Participants noted that this heterogeneity in platforms not only creates inconsistencies in functionality and interface but also introduces technical challenges that disrupt workflow efficiency. Such fragmentation has hindered the seamless adoption of the E-prescribing system, undermining user experience and potentially affecting the quality and timeliness of service delivery.

4.1.4. Insufficient Support from Health Insurers in Provision of Computer Hardware and Software

Interviewees highlighted that the implementation of the E-prescribing program has imposed additional financial burdens on healthcare service providers. These costs encompass internet subscription fees, upgrades to existing computer systems, and the procurement of essential equipment such as printers, paper, and other related materials. Participants emphasized that health insurance organizations have provided limited or no tangible assistance in covering these expenditures, thereby transferring the financial responsibility to healthcare facilities. This lack of infrastructural and technological support has been perceived as a significant barrier to the smooth and equitable deployment of the E-prescribing system.

4.1.5. Physicians' Unwillingness to Collaborate

Several participants attributed the slow progress of the E-prescribing program to physicians' limited cooperation and engagement. A number of respondents indicated that many physicians lacked familiarity with the current software systems and faced difficulties in identifying the most suitable user interface, leading to frustration and reduced adoption rates. Furthermore, software developers perceived a prevailing preference among physicians for traditional paper-based prescriptions over computerized systems, which has contributed to their reluctance in fully integrating E-prescribing into practice. As one participant noted, "The reality that physicians prefer writing prescriptions on paper to using computers is one of our deepest concerns." This resistance has posed a substantial obstacle to the program's effective implementation.

4.1.6. Inadequate and Unstable Internet Connectivity

Multiple interviewees emphasized that poor internet connectivity across the country presents a critical challenge to the effective deployment of the E-prescribing system, irrespective of its design quality. In addition to general network instability, participants pointed to the outdated and insufficient digital infrastructure within the Social Security Organization, including server limitations that hinder the provision of a stable nationwide connection. These technical shortcomings not only disrupt the continuity of service but also exacerbate user dissatisfaction, ultimately undermining the program's credibility and efficiency.

4.1.7. Increased Workload for Pharmacies

Several participants reported that the proliferation of multiple E-prescribing platforms has introduced additional procedural steps into pharmacy operations, creating an unnecessary administrative burden. These complexities were perceived to disrupt workflow efficiency and contribute to operational fatigue among pharmacy staff. Furthermore, participants highlighted that prolonged prescription processing times — often resulting from physician entry errors or intermittent internet connectivity — have led to increased patient waiting times and dissatisfaction. One pharmacist noted, "Currently, when dispensing medicine to each insured patient, the pharmacy must log into the portal of the corresponding insurance organization, which imposes numerous extra steps on the dispensing process." Such added procedural requirements not only strain human resources but may also negatively affect the timeliness and quality of pharmaceutical services.

4.1.8. Failing to Account for the Unique Context of Deprived Provinces

Participants emphasized that implementing the E-prescribing system in socioeconomically disadvantaged regions presents distinct challenges, primarily due to limited access to information technology infrastructure, insufficient basic amenities, and persistently poor internet connectivity. These structural limitations hinder the system's effectiveness and create disparities in service delivery across the country. Some interviewees noted that prior substantial investments in information technology by certain medical sciences universities have facilitated implementation in better-resourced provinces, whereas deprived regions — constrained by financial and infrastructural deficiencies — remain at a significant disadvantage.

One respondent illustrated the operational difficulties by stating: "Internet speed is slow, even in urban areas. The system suddenly generates errors or disconnects when there is a power outage, and sometimes we have to re-enter 20 types of medicines, ultrasounds, and tests

into the system. Meanwhile, the patient's voice in the consultation room and the noise from others cause further stress, making it difficult for the physician to work efficiently." Such conditions not only increase the administrative workload but also adversely affect the quality and timeliness of healthcare service provision in these regions.

4.2. Electronic Prescribing Software Challenges

4.2.1. Coding

One of the most significant technical challenges identified relates to the absence of standardized, comprehensive diagnostic, medicinal, and disease coding across different E-prescribing software platforms. Participants highlighted that, ideally, all organizations utilizing electronic prescriptions should be able to communicate using a unified coding system. However, this "common language" has yet to be established. As a result, variations in classifications and codes for identical medicines or services among insurance organizations create substantial difficulties for end-users. As one respondent explained: "When the same coding is not used, the received information does not match. Data is transferred, but according to different standards, and consequently, there is no aggregation."

In addition, physicians reported insufficient coding for numerous medications, radiological imaging procedures, and diagnostic tests. This gap often leads to misunderstandings between clinicians and patients, thereby undermining the effective use of the system. Moreover, a discrepancy exists between the coding options available within the software and those required by physicians in clinical practice. Respondents noted that earlier coding systems — based primarily on the relative value book — were designed with payment purposes in mind, whereas clinical prescribing requires condition-specific coding aligned with the physician's orders.

A further concern was the lack of suitable codes for certain imaging and laboratory procedures. Not only do many services require new codes, but the abundance of existing codes also complicates the process of identifying the correct one, diverting physicians' time away from essential clinical tasks. In some instances, laboratory services require additional tests that are not listed in the system, compelling laboratories to charge patients directly for these services. Moreover, test order forms in the current system often fail to specify test levels, limiting the accuracy and comprehensiveness of recorded results.

4.2.2. Missing Codes for Certain Medications

According to participants, several medications are not included in the E-prescribing system, which forces patients to bear additional out-of-pocket expenses for their prescriptions. Moreover, some physicians reported that they frequently spend considerable time searching for medications absent from the database, leading to patient dissatisfaction and frustration. One patient stated: "Yesterday, I visited the doctor, and he said that my medication had not been registered in the system, so I must obtain it without any insurance coverage."

4.2.3. Lack of a Unified Standard for Coding Services and Medications Across Software Systems

Some interviewees expressed concerns that the logic and procedures underlying the computerized prescribing software are unclear, causing physicians to question its effectiveness. Furthermore, insufficient attention to the timing and importance of pharmaceutical regulation was identified as another issue. "Some previous prescribing programs are not integrated with the new system. Many medications recorded in patient files or hospitals are missing in the new version."

4.2.4. Low User-Friendliness of the Existing System Interface

4.2.4.1. System Complexity

Numerous interviewees reported that the current version of the Social Security Organization's E-prescribing system lacks user-friendliness, creating difficulties for users and often resulting in wasted time. As one participant noted: "Existing systems are not user-friendly, which has led to resistance among physicians to adopt the system. Those willing to use it still encounter problems, while those unwilling cite usability issues as a justification for non-use."

4.2.4.2. Long Drop-Down Lists and Increased Risk of Error

Some physicians highlighted a significant risk of selecting incorrect medications due to the extensive drop-down lists, underscoring the urgency of addressing this issue to reduce errors.

4.2.4.3. Cumbersome Manual Entry of Medication Names

Several medical professionals expressed concern that the time-consuming process of manually typing full medication names during prescription registration limits the time available for patient interaction. Some believed this shifts physicians' focus away from essential clinical duties, such as thorough patient examination and fostering a therapeutic relationship, ultimately weakening the physician-patient bond and causing patient dissatisfaction.

4.2.4.4. Insufficient Decision Support

Participants indicated that the system's ability to suggest appropriate treatments and medications based on the primary diagnosis is severely limited and requires substantial enhancement. This limitation stems from the system's failure to provide accurate recommendations for many diagnoses. Additionally, a few physicians noted that the current system inadequately addresses warnings related to potential medical complications and the need for various prescription tests.

5. Discussion

The E-prescribing is a relatively recent innovation within healthcare systems, and identifying its limitations is a crucial step toward its successful nationwide implementation. This study aimed to systematically identify and categorize the weaknesses within the E-prescribing software and related processes to assist developers in addressing these shortcomings and facilitate broader integration.

The results indicated that, although the existing software significantly streamlines the prescribing process, substantial enhancements and optimizations remain necessary. Similarly, research by Michael Sweidan et al. highlighted that despite the widespread adoption of E-prescribing in primary healthcare (PHC) settings, there is a pressing need to upgrade the system and extend its application to other healthcare environments, including hospital departments (28). Furthermore, while E-prescribing has been shown to reduce medication errors and enhance prescription safety, as evidenced by the study conducted by Schiff et al., it remains vulnerable to certain error-prone processes (29, 30).

One of the key findings of this study is the MOHME inadequate leadership regarding the E-prescribing program. The results indicate that MOHME did not make a genuine effort to ensure the full implementation of the system. This was partly due to the lack of awareness or recognition of the program's importance among some of its deputies. Additionally, the Ministry's failure to establish a comprehensive vision and a clear, strategic roadmap significantly contributed to the program's delayed progress.

The findings of this study further highlight that insufficient training for physicians, as the primary users of the system, represents a significant barrier to the widespread adoption of E-prescribing nationwide. Correspondingly, the study by Eltajoury et al. aligns with these results, identifying inadequate infrastructure, limited educational and training opportunities, and shortages of both human and financial resources as key obstacles hindering the effective utilization of E-prescribing software (31). According to existing evidence, the proficiency and expertise of users in operating the E-prescribing system significantly influence the reduction of system-related errors. As users' skills improve over time, the advantages and effectiveness of E-prescribing systems become increasingly evident (32, 33).

William Hollingworth also demonstrated that initially, physicians exhibited strong resistance to E-prescribing due to their reluctance to adopt change; however, following positive experiences and increased familiarity with the system, their willingness to utilize it significantly increased (34). Several studies have identified six key factors contributing to errors in the E-prescribing process: The system itself, healthcare providers, patients, the healthcare team, the prescription task, and the workplace environment are identified as six key factors contributing to errors in the E-prescribing process. The most common errors reported include selecting incorrect medication names, reliance on default dosages, insufficient system-generated warnings, and issues related to remote medication administration (35, 36). The present study further revealed that inadequate warning mechanisms and the presence of incorrect medication names used by physicians undermine the effectiveness of the E-prescribing system. Our findings indicate that the system's poorly designed user interface hampers usability, consequently discouraging users from fully engaging with it.

In line with this, a separate study demonstrated that both the design of the Social Security Organization's E-prescribing system and pharmacists' initial perceptions — specifically their expectation of reduced operational errors through system use — significantly influence their intentions and the degree to which they adopt these technologies (3). Our findings further indicate that the lack of adequate infrastructure, especially in economically disadvantaged regions of the country, constitutes a major barrier to the full integration of E-prescribing systems. Similarly, a study conducted in Tehran province identified infrastructural and support-related factors as among the most critical facilitators and obstacles influencing the adoption of this technology. It is imperative that policymakers and national decision-makers demonstrate firm commitment to the implementation of E-prescribing and computerized prescription writing as essential components of the electronic health record system (37).

Similar to other studies, our research encountered several limitations. First, the relatively small sample size may limit the generalizability of our findings to the broader population of E-prescribing users in Iran. Second, since the interviews were conducted in mid-2022, some of the identified challenges related to E-prescribing may have since been addressed. Nonetheless, a notable strength of our study lies in the diversity of participants, which included pharmacists, physicians, experts, and patients, allowing for a comprehensive assessment of the E-prescribing system's weaknesses.

For future research, we recommend investigating the integration of E-prescribing systems with other health information systems, such as electronic health records and pharmacy management platforms. Additionally, conducting comparative studies across different provinces within Iran or between Iran and countries with similar healthcare infrastructures could provide valuable

insights into how regional disparities in infrastructure, training, and policy implementation influence the adoption of E-prescribing systems.

5.1. Conclusions

The findings of this study underscore that incorporating the insights and perspectives of diverse groups of E-prescribing users and service recipients is fundamental to achieving more effective implementation and serves as a means to address existing system flaws and deficiencies. Furthermore, based on the experiences of other countries in E-prescribing, one of the initial steps to enhance the current status of E-prescribing is to establish a dedicated responsible authority with sufficient power and accountability. Additionally, employing appropriate incentive mechanisms for E-prescribing users is crucial to encourage adoption and sustained use. Finally, integrating E-prescribing-related topics into the continuing education and retraining programs for physicians and other prescribers will support its effective and beneficial application.

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