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The effect of electronic prescription systems on pharmacy performance through evaluation of existing infrastructure in Kerman Iran

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Challenges such as illegible and incomplete paper prescriptions can disrupt pharmacy performance in medication dispensing. Implementing an electronic prescription system can help mitigate these issues. This study examines the impact of electronic prescription systems on pharmacy performance, focusing on evaluating existing infrastructure. Conducted in 2023 across 120 pharmacies in Kerman city, this cross-sectional descriptive-analytical study employed two researcher-developed questionnaires. Validity was ensured through expert review, and reliability was established using Cronbach's alpha (0.91 and 0.81) and test-retest methods. Data analysis included descriptive and analytical statistics, utilizing Pearson's test and linear regression. After the system was implemented, pharmacies achieved the highest mean performance in speed (3.51 out of 5) and the lowest in ease of use (3.18). A significant correlation was observed between the duration of system use, providers' educational background, and work accuracy ($P < 0.05$). Hardware facilities scored higher (3.66) than software facilities (2.32). Most infrastructure indicators are significantly related to pharmacy performance, except for hardware and speed indicators ($P = 0.10$). Despite the above-average performance after implemented, persistent challenges such as poor internet quality and insufficient training remain. Future research should investigate these factors separately to assess their impact on policymaking effectiveness.

Keywords Developing countries, Innovations and health, Electronic prescription systems, Pharmacy, Adoption

In the context of recording physician orders, various issues and challenges may arise, including illegibility, the use of inappropriate or non-standard names and terms, incompleteness, non-compliance with physician ordering rules, delayed prescription arrival at pharmacies, and inadequate access to patient information such as drug sensitivities. These problems are known to contribute to medication errors and adverse drug events[1–3]with severe cases potentially resulting in patient harm or even death instead of treatment[4]. Medical errors, particularly drug-related errors, have compromised the safety of healthcare systems and are recognized as a significant threat to patient safety, a critical aspect of healthcare[5].

Information and communication technology in prescribing presents a promising solution to address the limitations of manual prescribing[6,7]. Many developed countries have adopted electronic prescribing or computerized physician order entry systems, leading to enhanced patient care, improved medical outcomes, and reduced medication errors[8,9]. Electronic prescription systems are designed to digitally record medical orders, including drug prescriptions, tests, imaging requests, and other services, facilitating communication among healthcare providers[10]. The primary objective of this system is to transition the manual prescription process into an electronic format[11].

By utilizing computer communication networks, the electronic prescription systems enable the efficient storage and transmission of physician orders to pharmacies at the point of care[10]. This streamlined communication minimizes delays in information exchange between different healthcare units and pharmacies, ensures error-free and easily understandable prescriptions from service providers to pharmacies, enhances drug clarification processes (including drug type, dosage, and administration instructions), accelerates

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prescription fulfillment, and improves overall pharmacy productivity[12–17]. Given the complexity and error-prone nature of the medication prescribing and dispensing process, prescriptions must meet specific criteria such as legibility and comprehensiveness to prevent errors[18]. Manual prescribing remains a significant source of errors due to illegible handwriting or missing information like dose details or units of measurement, hindering the prescription process. These errors often stem from inadequate supervision of prescriptions or insufficient knowledge about drug information and the importance of complete data entry[19]. Various guidelines outline the minimum standards that prescriptions should adhere to[20,21]which can typically be met by implementing electronic prescription systems. Consequently, this system is recommended as a crucial element for enhancing accurate and correct transcription practices[22–24].

Several studies have demonstrated the effectiveness of electronic prescription systems in developed countries. For instance, Lowing et al. observed a significant impact of computerized physician order entry systems on the workflow of hospital pharmacists in the United States and the allocation of time across different pharmacy activities[16]. Similarly, MC Mullen et al. reported substantial improvements in pharmacists' workload, particularly in medication clarification processes and task prioritization, following implementation of electronic prescription systems in Michigan hospitals[14]. For example, one of the advantages of utilizing smart electronic systems in the pharmaceutical industry is virtual screening for drug discovery using a novel machine-learning approach[25]. However, in developing countries, the adoption status remains unclear as most healthcare systems either refrain from implementing electronic prescription systems due to financial constraints or face numerous operational challenges during early-stage implementation[26]. Current data reveal significant disparities in the adoption of electronic prescription systems across nations. While developed countries report utilization rates of 80–90%, only 30–40% of pharmacies in developing countries have implemented such systems. Regional analyses show particularly low adoption in Africa and South Asia (<25%), contrasting with relatively higher uptake in Latin America (40–50%). Electronic prescription systems in low- and middle-income countries, despite their high potential to improve medication access and enhance prescription monitoring, face numerous challenges. While some countries, such as Indonesia, possess basic infrastructure and could implement such systems by adopting successful models (e.g., Germany and the UK), barriers such as a shortage of skilled workforce, weak IT infrastructure, and the absence of transparent regulatory frameworks hinder their development[27]. Moreover, similar to the experience of online pharmacies in India and Kenya, the lack of clear regulations and inadequate enforcement of existing laws make it difficult to ensure effective oversight, even if such systems are implemented. For successful adoption, in addition to strengthening technical and legal infrastructures, investment in workforce training, financial incentives for physicians and pharmacies to adopt the system, and a risk-based regulatory approach are essential to ensure alignment with local needs and global standards[28,29]. Iran's electronic prescription systems implementation trails behind peer nations like Turkey and Malaysia, though emerging initiatives under its Digital Health Transformation program demonstrate measurable progress[30]. Collectively, developing nations face significant infrastructural, financial, and cultural barriers in implementing electronic prescription systems, necessitating further localized research and targeted investments to improve current conditions[31].

Unlike leading countries worldwide, Iran's adoption of electronic prescription systems has been significantly delayed and lacks an established history. Furthermore, insufficient government support, underdeveloped essential infrastructure, absence of financial incentives, and inadequate allocation of training resources for electronic prescribing systems have resulted in a primarily financially driven approach to their implementation[31,32]. The electronic prescription system was initially launched in 2015 in physicians' offices under contract with the Iranian Social Security Organization to streamline pharmacy and para-clinical center operations. However, full implementation officially commenced in March 2017 and extended to all cities nationwide by the end of 2018. Subsequently, the mandatory use of electronic prescribing in public and university hospitals was proposed in 2019, culminating in the digitalization of physician orders for individuals covered by armed forces insurance by the end of 2021[33]. Research has explored the system's impact on reducing prescription errors and enhancing patient safety[34–38]as well as investigating factors influencing its implementation and provider acceptance[39–43]and evaluating it from the perspectives of nurses and physicians in Iran[44–47]. However, there is a notable gap in studies assessing the system's effects on pharmacy performance and provider satisfaction. Given the recent implementation of the system and ongoing challenges in pharmacy utilization, evaluating its capabilities is crucial for improving healthcare services. Since pharmacy personnel are key system providers, assessing it from their viewpoint can significantly enhance its performance, sustainability, and utility. Therefore, this study aims to examine the influence of the electronic prescription system on pharmacy performance, with a focus on assessing the existing infrastructure.

Method

The conceptual model of this study is shown in Fig. 1.

The current study is a descriptive-analytical cross-sectional research conducted in 2023. The research population consists of all providers of the electronic prescription systems from a total of 230 pharmacies in Kerman, totaling 500 pharmacy providers. Participants were required to have at least six months of experience using the electronic prescription systems in pharmacies and at least six months of manual prescription filling experience. Sampling from pharmacies was carried out in a stratified random manner, and the sample size was determined using the following formula[48],

$$n = \left\{ \frac{z_{1-\frac{\alpha}{2}} + z_{1-\beta}}{0.5 \times \ \ln\left(\frac{1+r}{1-r}\right)} \right\}^2 + 3$$

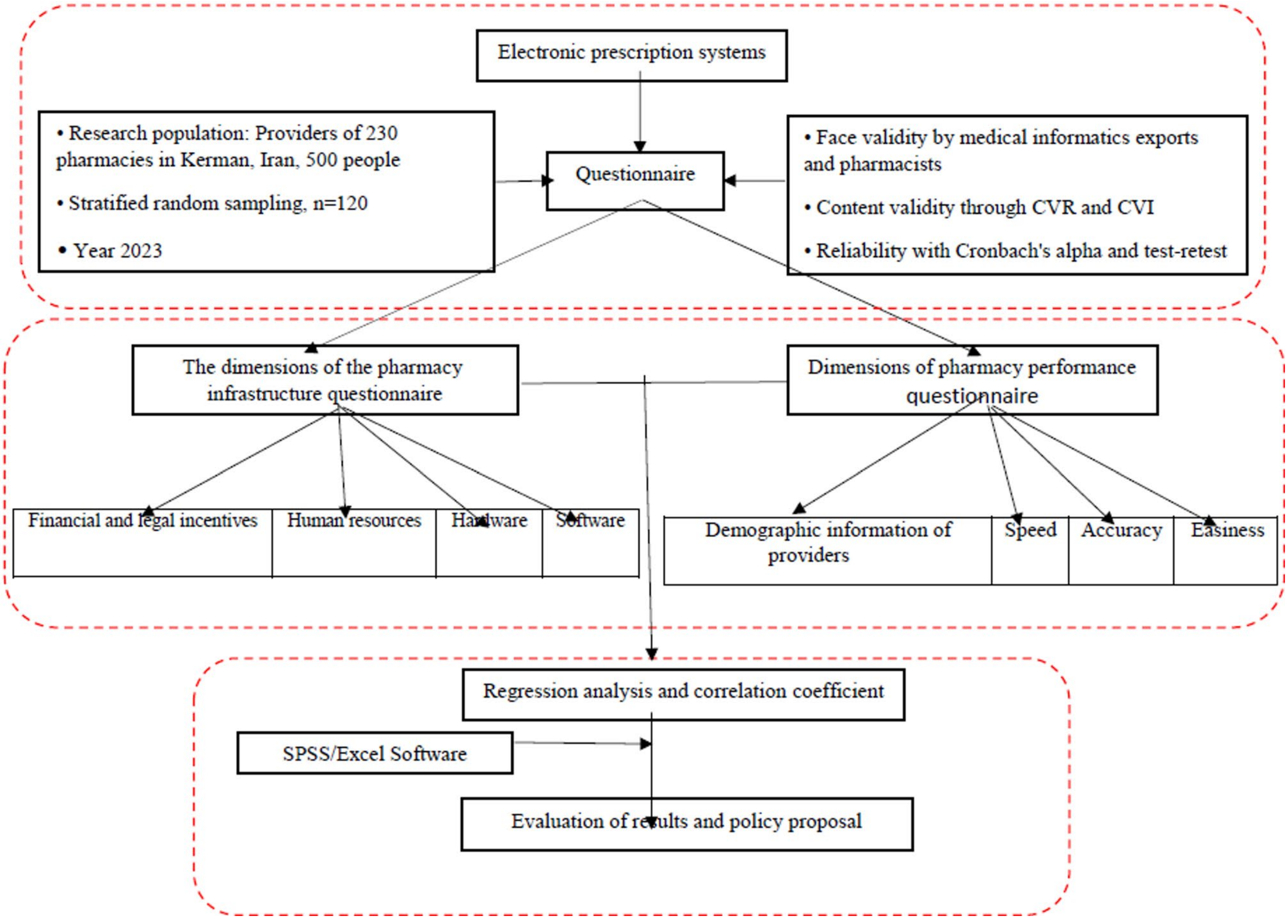

Fig. 1. Conceptual model of the study.

with a power of 0.90 (1- β), a type I error of 0.05 (α), and a Pearson's correlation coefficient (r) of 0.30. The calculated sample size was 113, which was increased to 120 to enhance the test's power.

Data collection tools included two questionnaires developed through an extensive literature review[12–16,24,49–51] a 90-minute specialized interview with a pharmacist having 25 years of experience, and using the experience of pharmacists and medical informatics professors. To evaluate the performance, the first questionnaire (including four sections: demographic information, speed, accuracy, and ease) was used. Demographic information (eight questions), workflow speed (seven questions), work accuracy (ten questions), and ease of use (eight questions) of the electronic prescription systems (Appendix A). The second questionnaire consisted of 21 questions evaluating the existing infrastructure in pharmacies, including three questions about software, six about hardware, five about human resources, and seven about financial and legal incentives (Appendix B). Face validity was confirmed by six medical informatics experts and four experienced pharmacists (Involved as participants in this study). In contrast, content validity was established through the calculation of Content Validity Index (CVI) and Content Validity Ratio (CVR)[52]. To assess the internal reliability of the questionnaires, Cronbach's alpha test was used, yielding a score of 0.91 for the first questionnaire and 0.81 for the second questionnaire. Also, to evaluate the stability the reliability of the questionnaires, the retesting method was used and based on the level of agreement in answering, for this purpose, the questionnaire was presented to 15 providers of the pharmacy, and after two weeks, the questionnaire was again distributed among the same providers and collected after completion. Data collection was conducted through in-person visits to pharmacies, with additional explanations provided as needed.

After data collection, it was entered into SPSS software version 26 for analysis. The Likert scale questionnaires used a scoring scale ranging from one to five (very low = 1, low = 2, medium = 3, high = 4, and very high = 5) to assess the identified parameters. The normality of data distribution was checked using the Kolmogorov-Smirnov test and skewness indices. Since the data were normally distributed, descriptive statistics, including frequency, percentage, mean, and standard deviation, were employed for data analysis. Pearson's correlation coefficient was used to assess the relationship between infrastructure variables and performance. Additionally, linear regression was utilized to examine the impact of independent variables such as provider demographic information (age, gender, work records, and system usage) on the dependent variable of pharmacy performance. The significance level for this study was set at 0.05.

Variable		Frequency	Percent	Mean	Standard deviation
Gender	Female	72	60	–	–
	Male	48	40	–	–
Education	Diploma	18	15	–	–
	Associate degree	9	7.5	–	–
	B.S.	46	38.3	–	–
	M.S.	11	9.2	–	–
	Ph.D.	36	30	–	–
Field of Study	Pharmacology	36	30	–	–
	Other fields of medical sciences	16	13.3	–	–
	Technical engineering	15	12.5	–	–
	Pharmacy dispensing course	18	15	–	–
	Other	35	29.2	–	–
Age		–	–	31.66	8.47
Work experience in pharmacy (years)		–	–	8.27	7.28
Work experience with computer systems in healthcare (years)		–	–	5.53	4.81
Work experience with electronic prescription systems (months)		–	–	16.14	9.31
Daily experience with the electronic prescription systems (hours)		–	–	6.73	2.48

Table 1. Demographic information of the participants.

Variable	Index	Mean	Standard deviation	The least	The most
	Speed	3.51	0.58	2	4.71
Performance	Accuracy	3.45	0.65	1.90	5
	Easiness	3.18	0.72	1.75	5
	Software	2.32	0.57	1	4
	Hardware	3.66	0.58	2.5	5
Infrastructures	Human resources	3.29	0.61	1.80	4.60
	Financial and legal incentives	2.48	0.68	1	3.71

Table 2. The mean and standard deviation of performance indicators and infrastructure of pharmacies.

Results

A total of 120 out of 160 providers who were invited to participate in the study took part. Among the participants, 60% were women, and the average age was 31.66 ± 8.47. The majority of providers held bachelor's degrees in various fields (38.3%), with 30% having a background in pharmacy. Results indicated that 52 individuals (43.3%) had over seven years of pharmacy work experience, averaging 8.26 years. Most providers had used the electronic prescription systems for more than twelve months (47.5%), with an average usage duration of 16.14 months, and they spent an average of 6.73 h per day using the system (Table 1).

Table 2 shows that following the implementation of the electronic prescription system, pharmacies' performance had the highest average score for speed (3.51 out of 5), surpassing the overall average, while the lowest score was for ease, with an average of 3.18. Overall, according to providers of speed, accuracy, and ease after the system was implemented of the electronic prescription system. The hardware infrastructure of pharmacies received the highest average score at 3.66, exceeding the average, whereas software scored the lowest at 2.32. Providers perceived the pharmacy infrastructure as lacking in software, financial, and legal incentives related to electronic prescription systems, while rating hardware and human resources as average.

The correlation between infrastructure and pharmacy performance after the system was implemented of the electronic prescription system

The correlation between two infrastructure variables and pharmacy performance was examined using Pearson's correlation coefficient. As shown in Table 3, a notable correlation was observed between all infrastructure indicators and pharmacy performance indicators, except hardware facilities and providers' work speed ($P = 0.10$), where the relationships were found to be statistically significant but weak. The strongest correlation was identified between hardware facilities and the accuracy of providers' work ($r = 0.41$).

The correlation between provider demographic information and pharmacy performance after the system was implemented of the electronic prescription system

According to Table 4, there is no significant relationship between provider demographic information and pharmacy performance in terms of speed. Gender, age, work experience in the pharmacy, history of using computer systems in the health field, and history of using the electronic prescription system each month did not

Performance infrastructure	Speed	Accuracy	Easiness
Software	0.31 = r $P = 0.0001$	$r = 0.39$ $p < 0.0001$	r-0.41 $p < 0.0001$
Hardware	$r = 0.15$ $P = 0.10$	$r = 0.41$ $p < 0.0001$	$R = 0.31$ $p < 0.0001$
Human resources	$r = 0.22$ $P = 0.02$	$r = 0.40$ $p < 0.0001$	$r = 0.31$ $p = 0.001$
Financial and legal incentives	$r = 0.21$ $P = 0.03$	$r = 0.34$ $p < 0.0001$	$r = 0.24$ $P = 0.01$

Table 3. Pearson's correlation coefficient between infrastructure indicators and pharmacy performance.

Demographic Information		Pharmacy Performance								
		Speed			Accuracy			Easiness		
		Mean ± S.D	Correlation Coefficient (0.95 C.I)	*P*	Mean ± S.D	Correlation Coefficient (0.95 C.I)	*P*	Mean ± S.D	Correlation Coefficient (0.95 C.I)	*P*
Gender	Female	3.53 ± 0.66	Ref	–	3.48 ± 0.61	Ref	–	3.25 ± 0.79	Ref	–
	Male	3.49 ± 0.43	− 0.13 (− 0.37, 0.11)	0.30	3.40 ± 0.72	0.05 (− 0.20, 0.29)	0.70	3.08 ± 0.61	− 0.01 (− 0.29, 0.26)	0.92
Field of Study	Pharmacology	3.46 ± 0.51	Ref	–	3.59 ± 0.63	Ref	–	2.93 ± 0.82	Ref	–
	Other fields of medical sciences	3.64 ± 0.53	0.14 (− 0.26, 0.54)	0.50	3.39 ± 0.77	− 0.55 (− 0.96, − 0.14)	0.01	3.38 ± 0.57	0.06 (− 0.40, 0.52)	0.80
	Technical engineering	3.81 ± 0.28	0.26 (− 0.13, 0.66)	0.19	3.06 ± 0.61	− 0.87 (− 1.27, − 0.46)	0.0001	3.37 ± 0.68	0.12 (− 0.33, 0.58)	0.60
	Pharmacy dispensing course	3.39 ± 0.54	− 0.06 (− 0.42, 0.31)	0.76	3.44 ± 0.35	− 0.34 (− 0.72, 0.03)	0.07	3.02 ± 0.45	− 0.10 (− 0.52, 0.32)	0.64
	Other	3.45 ± 0.74	− 0.08 (− 0.43, 0.26)	0.64	3.50 ± 0.71	− 0.44 (− 0.80, − 0.10)	0.01	3.35 ± 0.74	0.06 (− 0.34, 0.46)	0.78
Age		–	0.03 (− 0.10, 0.17)	0.65	–	− 0.02 (− 0.16, 0.12)	0.76	–	− 0.15 (− 0.30, 0.01)	0.07
Experience working	In pharmacy (years)	–	0.02 (− 0.02, 0.05)	0.35	–	− 0.03 (− 0.07, 0.01)	0.11	–	0.03 (− 0.01, 0.07)	0.17
	With computer systems in the field of health (years)	–	− 0.02 (− 0.06, 0.02)	0.38	–	− 0.01 (− 0.06, 0.03)	0.62	–	− 0.03 (− 0.08, 0.02)	0.26
	With electronic prescription systems (months)	–	− 0.01 (− 0.03, 0.01)	0.21	–	− 0.01 (− 0.02, 0.02)	0.91	–	− 0.03 (− 0.05, − 0.01)	0.02
	Daily with electronic prescription systems (hours)	–	0.03 (− 0.02, 0.07)	0.24	–	0.09 (0.05, 0.14)	0.0001	–	0.04 (− 0.01, 0.09)	0.14

Table 4. Correlation between demographic information and pharmacy performance indicators using linear regression.

show a significant relationship with pharmacy performance accuracy. However, there is a significant correlation between the daily use of the electronic prescription systems and the accuracy of pharmacy work. For every hour of daily use of the electronic prescription systems, the providers' accuracy score increased by 0.09 ($P < 0.0001$). Furthermore, the field of study showed a significant relationship with pharmacy work accuracy:

- - Providers with other medical sciences backgrounds had an average accuracy score 0.55 lower than pharmacists ($P = 0.01$).
- - Providers with technical and engineering backgrounds had an average accuracy score 0.87 lower than pharmacists ($P < 0.0001$).
- - Providers from other disciplines had an average accuracy score 0.45 lower than pharmacists ($P = 0.01$).

There was also a significant relationship between the frequency of using the electronic prescription systems each month and the ease of pharmacy work. For every month of increased usage history, the ease score of providers decreased by 0.03 ($P = 0.02$). However, no significant relationship was found between other demographic variables and pharmacy performance in terms of ease.

Discussion

The results of this study suggest that the implementation of the electronic prescription system has positively impacted the performance of pharmacies in terms of speed, accuracy, and ease of operations. The marginal difference in the average scores across these performance indicators indicates a consistent effect of the system on overall performance. Specifically, the system has had a greater impact on speed in dose detection and drug delivery compared to the ease and accuracy of operations within the pharmacy. Several studies have examined various performance indicators following the implementation of electronic prescription systems[10,12–16,35]. The main difference between the current study and previous research is that the focus of our study is on both performance indicators and the role and impact of existing infrastructure from the providers' perspective. This study aims to identify the operational needs of providers concerning the necessary infrastructure. Our results indicate that the implementation of the electronic prescription system has a more significant effect on pharmacy performance, particularly regarding the speed of dose detection and drug delivery, compared to the ease and accuracy of operations.

Consistent with these results, previous studies[13,15] examining the effects of Computerized Physician Order Entry (CPOE) systems on pharmacy performance and pharmacist workflow have reported significant reductions in prescription processing times, with a 97% decrease from order registration to approval. Following system implementation, pharmacists were able to allocate more time to clinical and administrative tasks, leading to an increase in order processing efficiency. Consequently, the adoption of such systems contributes to enhanced efficiency, workflow optimization, and overall productivity within pharmacies.

In a study[14]conducted several months after the implementation of electronic prescription systems, pharmacists reported improvements in various aspects of their workload, such as the process of clarifying medication orders and their ability to prioritize pharmacy tasks. However, according to the results of this study, the implementation of the electronic prescription systems did not significantly enhance the prioritization of daily tasks in pharmacies. This may be attributed to the limited adoption of the system by many providers. Furthermore, slow internet speed results in significant time consumption while using the system, rendering task prioritization in the pharmacy practically ineffective.

In the current study, the impact of implementing the electronic prescription systems on reducing drug interactions was not statistically significant. However, a separate study[53] indicated that pharmacy technicians play a crucial role in assisting pharmacists in preventing medication errors through electronic prescribing. The experience and knowledge of technicians in selecting appropriate medications are essential in supporting pharmacists' efforts to maintain patient safety with electronic prescriptions. Nevertheless, the technicians in the pharmacies included in this study, who were also providers with a history of using the electronic prescription system, lacked sufficient knowledge and experience in the pharmaceutical field. Unfortunately, in the community pharmacies under investigation, most providers other than pharmacists lacked expertise in this area and had academic backgrounds unrelated to pharmacy or even other medical sciences.

However, a study[17] has demonstrated that drug orders entered through electronic prescribing are linked to a notable decrease in the time taken for the physician to input the order until it is confirmed by the pharmacist, and they are less likely to necessitate pharmacist intervention. Nevertheless, as indicated by the results of this study, providers' proficiency in utilizing the system is crucial, and individuals from non-pharmacy backgrounds may be less precise in performing electronic prescribing tasks.

Iran performs better than other middle-income countries in electronic prescription systems adoption and integration but lags in rural access, cybersecurity, and workforce training. Addressing these gaps could position Iran as a regional leader in digital pharmacy systems[54,55].

Based on the results of the current study, pharmacy facilities, particularly the number of computers utilized, are relatively well-equipped for implementing electronic prescription systems. However, a notable issue concerning hardware facilities is the availability of printers in pharmacies. Often, a single printer is shared among multiple computer systems, leading to disruptions in pharmacy operations, decreased workflow efficiency, patient delays, and ultimately, patient dissatisfaction. Furthermore, a critical concern is the speed and quality of internet connectivity, as internet outages during peak pharmacy hours (such as evenings) can significantly impede pharmacy operations and patient care. Before implementing the CPOE system, essential infrastructure improvements are necessary. According to study results[56]reliance on computers during CPOE implementation presents challenges for electronic prescription systems. Common computer-related issues include slow processing speeds, internet connectivity problems, hardware failures leading to system crashes, and software malfunctions affecting electronic prescribing applications[57]. Both hardware and software components must be optimized to ensure a seamless electronic prescribing process and minimize errors.

One of the challenges in this area is the lack of training courses on how to use the system and familiarize users with pharmaceutical terminology. According to the findings, pharmacy service providers believe that implementing an electronic prescription system is easier for individuals with a technical engineering background or other fields, such as management and accounting, compared to pharmacists, who are the primary users of the system. This is because pharmacists have not received the necessary training in using computer-based systems. On the other hand, the findings indicate that pharmacists, due to their familiarity with pharmaceutical terminology, perform with higher accuracy compared to users with non-pharmaceutical educational backgrounds. Therefore, it would be beneficial to provide the necessary training courses for users.

Additionally, studies[58,59]indicate that the significance of education, training, and provider feedback outweighs financial and economic considerations. This highlights the importance of ongoing education and training to maximize system utilization. Increased provider awareness and proficiency with the system will contribute to its overall success. In this regard, specialized and professional training courses are necessary for the effective use of the electronic prescription system. Study[60] revealed that the shortage of skilled professionals is not limited to highly specialized positions but also affects mid-level roles. To address this deficit, companies should adopt more comprehensive strategies by combining international talent acquisition with strengthened local development programs. Effective recruitment strategies, including attractive compensation packages and adaptation to modern work practices, can help alleviate workforce shortages and enhance organizational competitiveness. An integrated approach that combines skilled talent acquisition with continuous investment in internal training is essential to ensure a qualified and competitive workforce. Study[61] identified realistic workforce development needs across a broad spectrum of Commonwealth countries. Addressing these needs through appropriate policy interventions will be crucial for expanding pharmaceutical workforce capacity and ensuring the delivery of high-quality pharmaceutical care and expertise in these nations. Consequently, workforce development in pharmacy settings requires macro-level educational policies, technological investments, and redefinition of professional roles.

In a study[43]various factors were identified as influential in the implementation of electronic prescription systems in Iranian pharmacies, including support for the law of electronic communication such as digital signatures, senior management support for system automation, provider training on electronic prescription systems, and the use of legal and financial incentives by the government. The results suggest that financial and legal incentives play a significant role in motivating providers to adopt and utilize the electronic prescription systems, leading to improved pharmacy performance. However, there is a lack of substantial financial and legal support in areas such as enhancing internet quality and ensuring pharmacies have emergency power devices during outages. Senior management support is crucial for the successful adoption of electronic prescription systems. With support from senior managers and financial backing for electronic prescription systems in pharmacies, provider acceptance and stakeholder satisfaction can be facilitated[62,63].

In light of the aforementioned issues, it is recommended to enhance the quality of internet services in pharmacies and to establish a custom network for the implementation of the electronic prescription system. Additionally, briefing sessions and specialized training courses should be held to enhance providers' awareness and understanding of the electronic prescription system. Moreover, it is suggested that financial and legal incentives be introduced to encourage physicians and pharmacy providers to adopt the electronic prescribing system. A macro-level financial planning policy should also be implemented to facilitate the deployment, utilization, and ongoing updates of this system.

Strengths and weaknesses of the study

The study is the first of its kind in Iran to evaluate the performance of pharmacies after the implementation of electronic prescription systems, providing valuable insights into the impact of this technology. Furthermore, sampling was conducted across diverse geographical areas within a major provincial capital. Given that the consistent implementation of electronic prescribing systems throughout Iran's provinces results from harmonized regulations, shared technical infrastructure, similar operational challenges, and uniform training and supervision protocols, the study findings are generalizable.

In this study, in addition to filling out the questionnaire questions, compiling the questionnaire, and getting the information, conducting a 90-minute interview with an experienced pharmacist added depth and context to the questionnaire responses.

One of the limitations of this study is that the performance of pharmacies after the implementation of the electronic prescription system was measured only from the perspective of pharmacy providers. Including client feedback could provide a more comprehensive evaluation of the system's performance in pharmacies. This study could benefit from expanding the scope to include a larger sample size or multiple provinces to increase the representativeness of the results. The reliance on questionnaire responses and a single interview may limit the depth of understanding and potential biases in responses. Additional data collection methods could strengthen the study's validity.

One of the potential areas for further research in this field is the evaluation of the role of education and expertise in medication errors and patient safety.

Conclusion

This study examined the performance of pharmacies in Kerman following the implementation of the electronic prescription system, focusing on speed, accuracy, and ease of use. The results suggest that pharmacy performance was moderately high, with providers from a pharmacy background demonstrating greater accuracy. Providers identified infrastructure challenges such as poor internet quality, lack of training, and insufficient support from senior management. The study highlights the significant impact of pharmacy infrastructure on enhancing pharmacy performance, particularly in terms of efficiency and accuracy. According to the results of this study, domestic policymakers must develop written plans for provider training and establish motivational incentives for the implementation and use of these systems. Additionally, considering the role and impact of infrastructure on the optimal performance of these systems, all organizations need to assess and conduct the necessary studies to ensure optimal infrastructure before implementing such systems.

Implications

The study underscores the importance of legal protection and support for successful electronic prescription implementation in pharmacies. To enhance senior management support for the electronic prescription systems, it is recommended to conduct awareness sessions and training programs for system providers. Additionally, offering financial and legal incentives can incentivize pharmacy providers to adopt the electronic prescription system. These results can inform policy development aimed at improving the drug delivery system infrastructure.

Data availability

The data generated and analyzed during this study are available from the corresponding author on reasonable request.

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Author contributions
All authors contributed to writing the article and revising the manuscript. Ms. Shokofeh Karimi collected and analyzed the data and wrote the first draft of the manuscript under the supervision of Dr. Yunus Jahani. Dr. Leila Ahmadian participated in the study's design and concept and revised the manuscript critically.

Declarations

Ethics approval and consent to participate
This study was approved by the Research Ethics Committee of Kerman University of Medical Sciences (Ethical code: IR.KMU.REC.1402.160). We confirm that all methods were performed under the relevant guidelines and regulations. Informed consent was obtained before participating in the study, and voluntary participation, anonymity of the participants, and confidentiality of information were considered.

Consent for publication
Not applicable.

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The authors declare no competing interests.

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