Healthcare Professionals' Perceptions of Implementing E-Prescribing: A Systematic Review

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Abstract. Electronic prescribing (EP) is a key innovation in improving the efficiency and safety of healthcare services. However, its implementation in healthcare facilities still faces various challenges. Therefore, it is crucial to evaluate healthcare professionals' perceptions of EP to assess its effective implementation across different service contexts. This systematic review aims to examine the barriers and facilitators of EP using the Theoretical Domains Framework (TDF). Article searches were conducted in Scopus, Web of Science, PubMed, and EBSCOhost databases from November 20 to May 1, 2025, using search terms related to e-prescribing, e-prescription, perspectives, and healthcare professionals. After screening, this review included 13 articles for further analysis. The most frequently reported barriers, which involve system and design issues, are categorized under the Environmental Context and Resources domain (9 articles). Meanwhile, the most frequently identified facilitators fall under the Beliefs about Consequences domain (13 articles), covering healthcare professionals' perceptions of efficiency, satisfaction, alignment with clinical standards, speed, and improved medication adherence. These findings indicate that a successful EP implementation is strongly influenced by organizational support, infrastructure availability, and training to ensure optimal use of the system in enhancing the quality of healthcare services.

Keywords: Electronic Prescribing, Healthcare Professionals, Perceptions, Facilitators, Barriers.

1 Introduction

Medication error (ME) is a critical issue in various healthcare services. Several studies have shown that ME is responsible for approximately 7,000 of 98,000 deaths caused by medical errors [1-2]. Furthermore, ME also has a significant economic impact, with estimated annual losses reaching up to USD 42 billion [3]. ME can occur throughout the prescription, transcription, dispensing, and administration stages of the medication process [4]. Nearly 50 % of ME incidents happen during the prescribing or ordering

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stage, making it a critical point in the treatment workflow [5]. This indicates that medication errors are a common issue, and most of their underlying causes are preventable.

To prevent ME and support healthcare professionals in medication-related services, an E-prescribing (EP) system has been developed to facilitate direct communication between physicians and pharmacists through a computerized platform. This integration directly improves workflow efficiency and reduces potential prescribing errors [6]. Validated prescriptions through the system can support adherence to clinical guidelines, reduce the risk of medication administration errors, and improve patient compliance with treatment [7-9].

However, despite EP's success in addressing issues related to handwritten prescriptions, new challenges emerge in its implementation. According to a previous study on EP implementation, approximately five errors occur in every 100 e-prescriptions from prescribing facilities [10]. The highest prevalence of errors in electronic prescriptions has been reported to reach 91 %, with the most common errors involving incorrect dosages (41 %) and drug selections (19 %) [11]. Moreover, technical issues such as system failures or network problems frequently hinder the effective implementation of e-prescribing [12].

To achieve EP's successful implementation, the perceptions of healthcare professionals such as physicians, pharmacists, and nurses as primary users of the system must be taken into consideration. Understanding the specific needs and challenges of each professional group is a strategic step toward ensuring the sustainability and effectiveness of EP in clinical practice. Therefore, evaluating healthcare professionals' perceptions is critical to improving the quality of healthcare services in the future.

This systematic review employs the Theoretical Domains Framework (TDF) to explore healthcare professionals' perceptions of EP implementation. This framework is used to categorize various barriers and facilitators to e-prescribing (EP) into relevant theoretical domains [13]. To date, no systematic review has comprehensively integrated the findings of relevant studies using a structured theoretical approach such as TDF. The findings of this review are expected to provide useful recommendations for improving medication management, enhancing the quality of patient care, and strengthening the implementation of health information technology in healthcare systems.

2 Methods

This study employed a systematic and consistent approach, following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) criteria (Fig. 1).

2.1 Search Strategy

The literature search was conducted from November 20, 2024, to May 1, 2025, in several electronic databases, namely Scopus, Web of Science, PubMed, and Ebscohost. The search strategy involved a combination of relevant keywords, i.e., "electronic prescribing," OR "e-prescription," OR "e-prescribing," OR "electronic prescription," AND "Perspectives," AND "Healthcare Professionals." Boolean operators OR and AND were applied to combine these terms systematically.

2.2 Eligibility Criteria

The inclusion criteria for this review are as follows:
1. Original research articles published in English,
2. Articles discussing the implementation of an operational EP system,
3. Articles reporting the perspectives of healthcare professionals on the EP system, and
4. Articles published between 2019 and 2024.

Meanwhile, the exclusion criteria are as follows:
1. Articles that are not original research (e.g., literature reviews, opinion pieces, or policy reports),
2. Articles that do not include the perspectives of healthcare professionals on the use of EP, and
3. Articles whose full text is not available.

2.3 Study Selection

The main researcher (PA) performed the initial screening of titles and abstracts based on their relevance to the research objectives. Two researchers, (SA) and (LL), reviewed and discussed the full text of selected articles. Then, two researchers, (PA) and (SA), conducted data extraction and quality assessment. Finally, the reviewer (VQ) decided on the appraisal results.

2.4 Data Extraction

The extracted data includes the study's country of origin, research setting, type of EP system used, population characteristics, and research duration. Information regarding barriers and facilitators to EP implementation is classified into the domains of the TDF. This mapping process aims to enable a more in-depth analysis of the factors that influence the EP system implementation by healthcare professionals [13].

2.5 Quality and Risk of Bias Assessment

The quality of the reviewed articles was assessed using the JBI critical appraisal tool for cross-sectional studies [14]. A summary of the quality assessment outcomes is presented in Table 1.

3 Results

3.1 Article Selection

The flow of the article selection process is displayed in Fig. 1. A total of 260 studies were identified through database searches, which were reduced to 218 articles after removing duplicates (n = 42). Among these studies, 180 articles were excluded based on title and abstract screening, leaving 38 articles for further consideration. A manual search yielded an additional three articles, which were also assessed for eligibility. After a thorough full-text evaluation, 13 articles were deemed relevant and included in the synthesis.

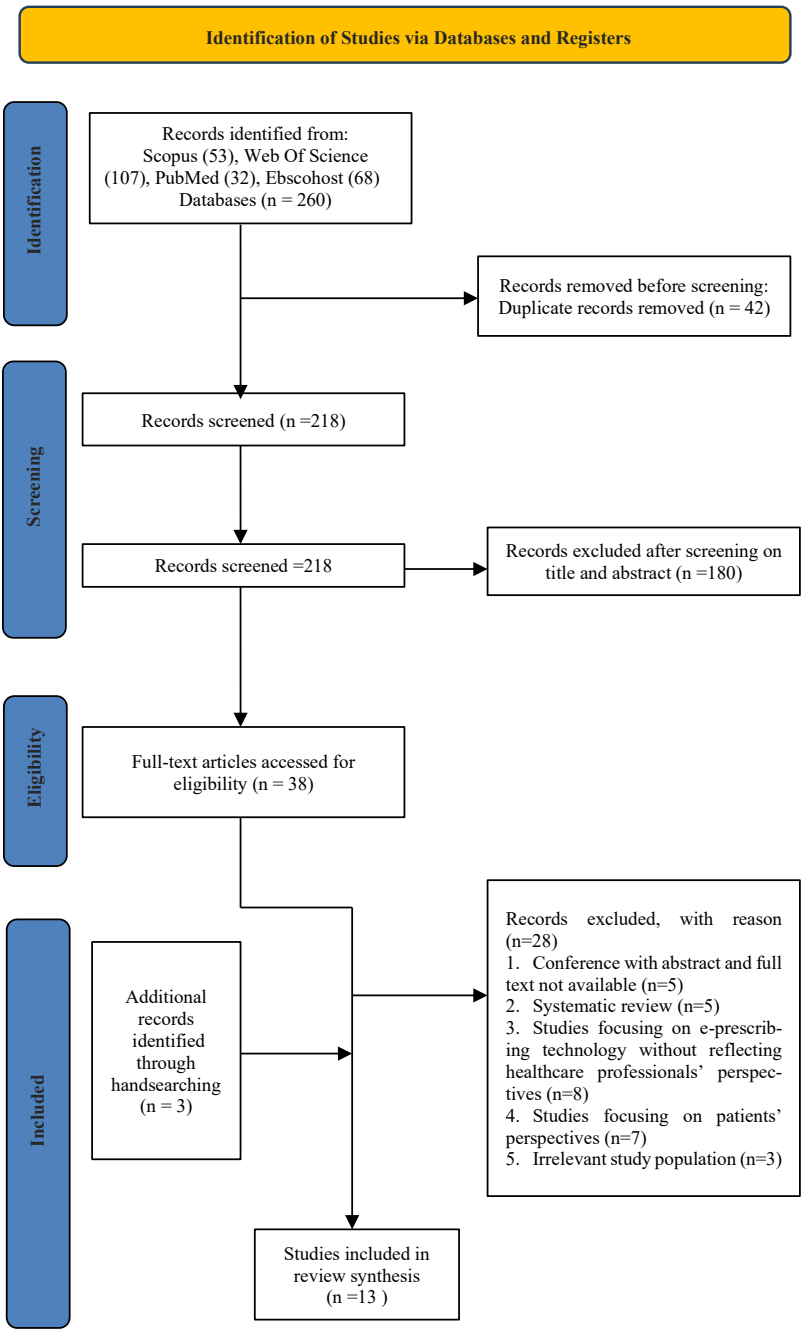

Fig. 1. PRISMA Flow Diagram

3.2 Assessment of Quality

All 13 articles reviewed in this study display excellent methodological quality and meet the established standards and guidelines. Based on the results of the quality assessment, no articles are excluded from this review. A summary of the methodological assessment findings is presented in Table 1.

3.3 Study Characteristics

The characteristics of the included studies are summarized in the data extraction table (Table 2). The studies analyzed in this review were published between 2019 and 2024. This review included 13 studies, with research locations reflecting geographical diversity. Turkey contributed the highest number of studies, namely five articles, followed by Libya with two studies. Meanwhile, Belgium, Iran, Pakistan, Ethiopia, Saudi Arabia, and Greece each contributed one article. This geographical variation represents regions from Europe, North Africa, Western Asia, and South Asia, providing a broader understanding of how healthcare professionals perceive the implementation of EP.

3.4 Barriers to E-Prescribing

Barriers to the implementation of EP by healthcare professionals can be classified into three main domains of the Theoretical Domains Framework (TDF), as shown in Table 3.

Environmental Context and Resources. All three professional groups consider infrastructure limitations as the main obstacle, with common complaints including slow hardware, frequent system disruptions, and the lack of technical support when needed. From the perspective of physicians, the main challenge is the absence of features for clinical decision support [15-18]. Meanwhile, pharmacists [15, 19-21] and nurses frequently encounter issues concerning discrepancies between prescribed medications and the inputted data, which may lead to medication errors [22].

Knowledge. This domain highlights differences in how physicians and pharmacists view and comprehend the EP system. For physicians, the main barriers to EP implementation include a lack of comprehensive understanding of EP system operation [16, 19, 21]. Senior physicians have been reported to experience greater difficulty understanding and operating the system than their younger counterparts [23]. Meanwhile, pharmacists often struggle to correctly interpret prescriptions, especially in identifying drug codes and understanding error messages generated by the system [20].

Social/Professional Role and Identity. This domain primarily applies to physicians since their role in EP often entails extensive computer usage at the expense of direct patient engagement [17].

3.5 Facilitators to E-Prescribing

The benefits of EP implementation by healthcare professionals can be explained through five domains within the TDF, as presented in Table 4.

Beliefs About Capabilities. This domain reflects healthcare professionals' beliefs about their ability to use the system. Both pharmacists [15] and nurses [22] have positive perceptions of EP implementation, stating that EP is relatively easy to use and understand. This indicates their confidence in operating the system.

Beliefs About Consequences. This domain contributes to the most positive perceptions among healthcare professionals. Physicians believe that EP is more reliable than manual prescriptions as it enhances efficiency, clinical service standards, and patient satisfaction [16-18, 24-25]. Pharmacists view the system as a way to accelerate prescription processing and improve accuracy [15, 18, 19, 21, 24, 26], while nurses perceive EP as a tool that increases patients' medication adherence [24].

Memory, Attention, and Decision Processes. According to physicians, well-integrated systems support more accurate decision-making in prescribing [15, 18]. Meanwhile, pharmacists and nurses consider EP as helpful in preventing errors in medication administration, primarily by displaying data systematically [24, 26].

Environmental Context and Resources. Physicians perceive that EP optimizes the prescribing process while reducing cases of inappropriate prescriptions. The system is viewed as a supportive tool for more efficient and controlled clinical practices [17, 18].

Social Influences. All three professional groups agree that e-prescribing facilitates interprofessional communication. Smoother collaboration among healthcare professionals improves coordination and the overall quality of patient care [18, 22, 24, 27].

4 Discussions

This systematic review explores the perspectives of physicians, pharmacists, and nurses on the implementation of electronic prescribing (EP) in healthcare practices. Numerous studies have reported that healthcare professionals generally perceive EP as having a positive effect on operational efficiency and patient safety. However, the findings are not uniform across these studies. Perceptions vary across professional groups in terms of perceived benefits, levels of technology adoption, and readiness to embrace digital transformation.

Table 1. Assessment of quality

Citation	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Bulut et al., 2019 [18]	Y	Y	Y	Y	Y	N	Y	Y
Van et al., 2020 [20]	Y	Y	Y	Y	Y	Y	Y	Y
Raeesi et al., 2020 [17]	Y	Y	Y	Y	Y	Y	Y	Y
Zaffar et al., 2020 [24]	Y	Y	Y	Y	N	N	Y	Y
Bilgener and Bulut, 2021 [21]	Y	Y	Y	Y	N	N	Y	Y
Eltajoury et al., 2021 [16]	Y	Y	Y	Y	N	N	Y	Y
Hayavi-Haghighi et al., 2021 [22]	Y	Y	Y	Y	N	N	Y	Y
Maatuk et al., 2022 [26]	Y	Y	Y	Y	N	N	Y	Y
Teferi et al., 2022 [28]	Y	Y	Y	Y	Y	Y	Y	Y
Alsahali et al., 2023 [19]	Y	Y	Y	Y	N	N	Y	Y
Grammatikopoulou et al., 2024 [15]	Y	Y	Y	Y	N	N	Y	Y
Havayi et al., 2024 [23]	Y	Y	Y	Y	Y	Y	Y	Y
Jeddi et al., 2024 [25]	Y	Y	Y	Y	N	N	Y	Y

Table 2. Data extraction details

Citation	Country	Setting	Electronic system used (type/ brand if stated)	Population /Sample Size	Duration of Study
Bulut et al., 2019 [18]	Turkey	Family physicians working in Turkey	MEDULA	1534 family physicians	May 2013
Van et al., 2020 [20]	Belgium	Community pharmacists in Belgium	Recip-e	246 community pharmacists	March – May 2018
Raeesi et al., 2020 [17]	Iran	Healthcare clinics and hospitals operating under the Division of Medical Services of the Social Security Organization (SSO) in Sistan and Baluchistan Province, Iran	Tamin ICT Information and Communication Technologies	82 physicians	The study was conducted in 2018.

Citation	Country	Setting	Electronic system used (type/ brand if stated)	Population /Sample Size	Duration of Study
Zaffar et al., 2020 [24]	Pakistan	Healthcare professionals in the public sector hospital (Lahore, Pakistan)	N/A	303 HCPs (101 physicians, 101 pharmacists, and 101 nurses)	July – August 2018
Bilgener and Bulut, 2021 [21]	Turkey	Community pharmacies in Turkey	MEDULA	378 pharmacists	February – April 2019
Eltajoury et al., 2021 [16]	Libya	Benghazi Medical Center, Libya	N/A	100 physicians	Jan – March 2020.
Hayavi-Haghighi et al., 2021 [22]	Iran	Hormozgan University of Medical Sciences in Iran	N/A	353 nurses	The study was conducted in 2019.
Maatuk et al., 2022 [26]	Libya	Hawari General Hospital, Benghazi Pediatrics Hospital, and Benghazi Medical Center	N/A	100 pharmacists	The study was conducted in 2022
Teferi et al., 2022 [28]	Ethiopia	Public hospitals in East and West Gojjam zones, North Ethiopia	N/A	384 physicians	February 5 – March 30, 2021
Alsahali et al., 2023 [19]	Saudi Arabia	Community pharmacists in the Qassim region of Saudi Arabia	Wasfaty	124 pharmacists	September – November 2022
Grammatikopou-lou et al., 2024 [15]	Greece	HCP in Greece	IDIKA	430 HCPs (129 primary healthcare physicians, 164 specialized medical doctors, and 137 pharmacists)	August 31, 2021, to March 7, 2022,
Hayavi-Haghighi et al., 2024 [23]	Iran	Physicians working in university hospitals in Iran	Shafa, Dinad, and EP	105 physicians	April – May 2023
Jeddi et al., 2024 [25]	Iran	Clinics of the Saveh Social Security Organization in Iran	Electronic Prescribing System (EPS)	98 physicians	The study was conducted in 2020.

Table 3. Representation of E-Prescribing barriers with the TDF domain

TDF DOMAIN	Barriers		
	Physicians	**Pharmacists**	**Nurses**
Knowledge	**1. Lack of Understanding of the System** [19, 21, 23,17] • Prescription code input errors • Failure to input the diagnosis • Incomplete patient information **2. Senior Physicians' Limitations** [23] Senior doctors face greater difficulties in understanding and using e-prescribing compared to their younger counterparts	1. Errors in identifying drug codes [20] 2. User confusion when encountering error messages in the e-prescription system [20]	N/A
Social/professional role and identity	Greater interaction with the computer than with the patient [17]	N/A	N/A
Environmental context and resources	**1. System Features** [15, 17, 23] • Lack of features for monitoring side effects, drug interactions, and patient allergies • No automatic alert system when drug dosage exceeds safe limits • Incorrect drug dosage forms (e.g., ml, mg, tablets) • No access to patient photos for identification • Time-consuming medication input process • High costs associated with designing and activating the software **2. System Issues** [17, 18] • System and network problems • Inability to make changes after the prescription is submitted	1. Unclear dosage instructions [15] 2. Lack of routine system maintenance [15] 3. Medications listed in the system are not available in the pharmacy [19] 4. Slow system response [20-21] 5. Technical barriers [20] 6. Organizational barriers [20]	Absence of alert features, contraindication warnings, and medication error notifications [22]

Table 4. Representation of E-Prescribing facilitators with the TDF domain

TDF DOMAIN	Facilitators		
	Physicians	**Pharmacists**	**Nurses**
Beliefs about capabilities	N/A	EP is not difficult to use, clear, easy to understand, and easy to learn [15].	EP is easy to learn [22]
Beliefs about consequences	**1. Reliability** [21, 23] • Eliminate handwriting and simplify the prescription process • Provide safer and more reliable records • Reduce prescription forgery **2. Satisfaction** [17, 21] • Enhance patient satisfaction • Allow more time to be allocated for interacting with patients • Reduce patient waiting time **3. Efficiency and Ease of Use** [17, 21, 23] • Save physicians' working time • Speed up task completion • Reduce patients' financial burden of medication use **4. Alignment with Clinical Standards** [24-25] • EP is more clinically appropriate than manual prescribing	**1. Speed** [15, 18, 21, 26] • Accelerate prescription processing and improve work efficiency **2. Accuracy** • Reduce errors in medication selection and dispensing [15, 19, 25] • Enhance prescribing safety [24] • Improve patient medication management, drug interaction monitoring, and inventory control [19] **3. Cost Reduction** [26] • Lower healthcare system costs **4. Influence on Patient Behavior** [24] • Positively affect patient medication adherence	Improve patient medication adherence [24]
Memory, attention, and decision processes	• Provide optimal access to patients' prescription history, thus supporting medication decision-making [15] • Offer access to patients' medication history to simplify treatment follow-up [18]	Reduce errors in medication administration [24, 26]	Prevent errors in medication administration [24]

Table 4 (Continued). Representation of E-Prescribing facilitators with the TDF domain

TDF DOMAIN	Facilitators		
	Physicians	**Pharmacists**	**Nurses**
Environmental context and resources	• Save paper and printer ink usage [17, 18] • Reduce patient waiting time [18] • Optimize organizational resources through the electronic drug registration system [17] • Reduce prescribing-related issues [17]	N/A	N/A
Social influences	Reduce disputes between patients, physicians, and pharmacists [18]	Facilitate a smooth flow of information between patients, doctors, and pharmacists [15, 24]	Facilitate easier communication with other departments, such as pharmacy and laboratory [22].

Successful EP implementation depends not only on the sophistication of the technology used but also on the extent to which healthcare professionals believe in their ability to operate the system. In this regard, the Beliefs about the Capabilities domain play a vital role in shaping healthcare professionals' readiness and acceptance of technology in clinical settings. In general, pharmacists and nurses perceive EP as easy to use in daily practice [13, 17]. On the other hand, there is more variation in acceptance among physicians, possibly due to differences in age, experience, and clinical context. Several studies have presented similar findings that perceptions of EP benefits vary across professions. Physicians emphasize clinical advantages, pharmacists give more attention to operational aspects and medication management, while nurses often have more limited experience with the system in daily practices [7, 29].

System integration that supports clinical decision-making, such as access to patients' prescription histories and drug interaction alerts, is associated with the Memory, Attention, and Decision Processes domain. Physicians, pharmacists, and nurses perceive these features as helpful in reducing medication errors and streamlining the therapy follow-up process [7, 15, 17]. These findings highlight that system support for clinical cognitive processes is critical for enhancing decision-making accuracy.

The system's effective support for clinical reasoning processes positively affects users' perceptions of its outcomes, as reflected in the domain of Beliefs about Consequences. Physicians consider EP more clinically appropriate than manual prescribing, particularly in terms of prescription safety and accuracy [30]. According to Albarak et al. (2014), EP systems are associated with fewer prescription errors than handwritten prescriptions [31]. Similarly, Ababneh et al. (2020) reported that medication errors are five times more likely to occur with paper-based systems [32]. These findings are in line with another study by Yugandhar et al. (2017), who found a 75 % reduction in prescription errors with electronic systems, showing an error rate of only 8.4 %, compared to manual prescriptions, whose error rate reaches 33 % [33]. From the perspective of efficiency, pharmacists noted that EP accelerates workflow and allows more time to interact with patients [34]. On average, a single prescription only takes 1 minute and 22 seconds [35]. This significantly reduces administrative burdens and enhances patient education [7, 10]. In practice, Zaffar et al. (2020) reported that nurses view EP as a system that improves service efficiency and patients' medication adherence [24].

The benefits of EP implementation, particularly in facilitating communication among healthcare professionals, are also strongly linked to the Social Influences domain. Physicians, pharmacists, and nurses agree that the system ensures smoother interprofessional coordination throughout the prescribing and dispensing processes. This positive impact extends beyond workflow, directly benefiting patients [36]. In their study, Kenawy and Kett (2019) found that the percentage of prescription corrections from pharmacists to physicians declined from 20.4 % to 7.9 %, suggesting a notable decrease in interprofessional callbacks and patient waiting times at the pharmacy [36]. This finding supports a prior study by Lanham et al (2016), who reported that the use of EP saves patients' time and increases pharmacy staff productivity due to a more streamlined and less obstructed information flow [37]. This signifies that improved interprofessional communication through the use of electronic systems enhances overall service efficiency.

Although EP offers numerous advantages to both healthcare professionals and patients, various barriers to its implementation, particularly those pertaining to potential disruptions that may lead to medication errors, cannot be disregarded. The Social/

Professional Role and Identity domain highlights the challenges faced by physicians, primarily with regard to the additional time required to input data into the system. This lengthy data entry process often makes physicians focus more on the computer screen, thus reducing their time to engage in face-to-face interaction with patients [2, 10, 17, 27, 30]. Compared to manual prescribing, EP also requires more clarification from pharmacists to prescribing physicians due to missing, inaccurate, or ambiguous information issues that can negatively impact patient safety [27, 28].

Errors in prescription processing using EP are often linked to healthcare professionals' understanding of the system, which falls under the Knowledge domain. Although pharmacists reported fewer issues than physicians, some pharmacists still experienced difficulties identifying drug codes and confusion when encountering system error messages [20]. Nevertheless, as the primary users of EP who are responsible for inputting prescriptions into the system, physicians frequently face more complex challenges. Factors such as age and work experience significantly influence system usage among physicians; those with longer years of service tend to have lower perceptions of ease of use (effort expectancy) and system benefits (performance expectancy) [23, 24, 42]. This is closely related to technostress, or anxiety about technology, which triggers adverse emotional reactions when interacting with computer systems [43]. Computer anxiety can hinder effort expectancy and lower an individual's intention to use technology [33-36]. Inaccurate use of EP systems by physicians increases the workload of pharmacists since they have to spend more time clarifying prescriptions [12, 48].

A misalignment between technology design and user expectations can also result in unintended system failures, which can lead to errors and inefficiencies in clinical workflows [49]. Previous studies have underlined the importance of visual design elements, such as information layout and color emphasis, in improving system usability and reducing the likelihood of user errors [50-52]. In terms of efficiency, physicians value EP's ability to reduce patient waiting times through prescription process optimization [27, 53]. However, all three professional groups have reported significant technical challenges, particularly those related to hardware, software, and insufficient IT systems support [54]. Healthcare professionals also emphasize the need to integrate clinical information—such as drug interaction data, patient allergy records, and automatic alerts when drug dosages exceed safe limits—into the system [55, 56]. These features are essential for ensuring therapeutic accuracy and minimizing the risk of medication errors [15, 23].

Various effective strategies to improve EP's quality have been identified in numerous prior studies, e.g., by integrating a Clinical Decision Support System (CDSS) into the system. CDSS relies on the integration of electronic health records (EHRs), medical knowledge databases, and intelligent technologies such as artificial intelligence (AI) and machine learning (ML) to provide evidence-based recommendations for diagnosis, treatment, and care management [57, 58]. The addition of CDSS to EP systems has been shown to offer specific benefits, such as providing E. coli resistance data to support antibiotic selection [59], improving prescription safety for patients with impaired renal function [60], and significantly reducing false positive drug interaction alerts from 43 % to 3 % [61].

Support from the organization is another crucial factor in ensuring the successful implementation of an EP system. In this regard, limited interprofessional training and inadequate system maintenance can be significant barriers to EP implementation [62].

Training for new staff and continuous software updates and maintenance are among the essential efforts that must be made [63-65]. Strong organizational support ensures that technology is not only available but also operates optimally to support clinical practice [66, 67].

5 Conclusion

The implementation of e-prescribing (EP) among physicians, nurses, and pharmacists has contributed positively to improving patient safety, prescription process efficiency, and medication adherence. However, the system still faces various challenges, necessitating various strengthening strategies across several aspects.

Organizations are essential for ensuring that the developed system addresses the needs of its users. A deep understanding of these needs will help create a technically functional, accepted, and optimally used system in daily practices. In addition, the successful implementation of EP greatly depends on adequate infrastructure support, both in terms of technology and human resources.

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