The Impact of e-Prescribing on Improving Healthcare Service Quality: A Systematic Review

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Abstract. The advancement of digital health technologies has influenced various aspects of healthcare, including the adoption of electronic prescribing (e-prescribing) systems. E-prescribing is designed to reduce prescription errors, streamline processes, and improve satisfaction among healthcare providers and patients. However, evidence on its overall impact in real-world settings remains limited. This systematic review aims to evaluate the effects of e-prescribing on healthcare quality, focusing on patient safety, system efficiency, usability, and patient satisfaction. A literature search was conducted across PubMed, Web of Science, ScienceDirect, and Scopus for studies published between January 2021 and March 2025. Ten eligible studies, including cross-sectional, quasi-experimental, qualitative, and randomized controlled designs, were selected following PRISMA guidelines. The methodological quality was assessed using the Joanna Briggs Institute (JBI) tools. Findings indicate that e-prescribing contributes to a reduction in medication and prescribing errors, improved workflow efficiency, and better communication among healthcare teams. Both user and patient satisfaction also increased, largely due to faster service and enhanced medication safety. Although initial implementation may face usability challenges, these can be mitigated through proper training. In conclusion, e-prescribing plays a vital role in enhancing healthcare quality and should be considered a strategic component in modern clinical practice.

Keywords: Electronic Prescribing or E-Prescribing, Medication Errors, Patient Safety, Healthcare Efficiency, User Satisfaction

1 Introduction

Pharmaceutical services are a fundamental component of hospital-based healthcare, with the primary goals of enhancing patient safety and satisfaction. These services are vital for achieving optimal therapeutic outcomes, particularly in hospital settings where effective medication management is central to patient care. The adoption of e-prescribing represents a significant innovation in pharmaceutical practice, aiming to

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improve workflow efficiency, minimize prescribing errors, and reduce patient waiting times. This system enhances the accuracy, safety, and overall effectiveness of the medication prescribing process [1,2] . E-prescribing integrates electronic medical records to streamline the entire prescription cycle—from prescription entry and review, through medication preparation and dispensing, to patient counselling, medication use, and therapeutic monitoring [3].

Advancements in digital health technologies have significantly reshaped various dimensions of healthcare delivery, including the introduction of e-prescribing. E-prescribing refers to the digital generation and transmission of prescriptions from healthcare providers directly to pharmacies, replacing conventional handwritten methods. Traditional prescribing practices are often associated with a range of medication errors, such as inappropriate drug selection, incorrect dosages, and delays in medication administration. In an effort to address these issues, healthcare systems are increasingly adopting e- prescribing as a means to enhance prescription accuracy, optimize workflow efficiency, and mitigate the risks linked to manual prescribing. One of the key contributors to preventable medication errors is illegible handwriting, and e-prescribing offers a viable solution to reduce such errors by ensuring clearer and more reliable prescription communication [3].

E-prescribing is designed to improve the accuracy, efficiency, and safety of the medication prescribing process, thereby contributing to better healthcare service delivery [4] . Unlike conventional handwritten prescriptions, e-prescribing allows clinicians to generate and transmit prescriptions digitally, minimizing the risk of medication errors and supporting more integrated and coordinated care. This system plays a crucial role in enhancing patient safety by reducing prescription-related mistakes. Through integration with electronic medical records, e- prescribing assists physicians in aligning prescriptions with the hospital formulary and provides insights into institutional drug utilization patterns. Continuous efforts are essential to uphold patient safety standards, and the adoption of e-prescribing in clinical practice reflects a strategic approach to mitigating medication-related risks and promoting safer healthcare environments [5,6].

This systematic review aims to evaluate the impact of e-prescribing on various dimensions of healthcare quality, with particular attention to patient safety, service efficiency, and satisfaction among both users and patients. By synthesizing findings from empirical studies conducted globally, the review identifies recurring trends in both the benefits and challenges associated with e- prescribing implementation. The integration of diverse research results offers a comprehensive and current overview of real-world outcomes. This evidence base serves as a valuable resource for policymakers, healthcare administrators, and clinicians in optimizing e-prescribing systems to enhance the overall quality of care.

2 Methods

2.1 Study Design A

This systematic review aims to evaluate the impact of electronic prescribing (e-prescribing) on healthcare quality, with specific emphasis on patient safety, efficiency, and the satisfaction of both users (healthcare providers) and patients. The studies included in this review encompassed a variety of research designs, such as cross-sectional studies, qualitative research, quasi- experimental studies, and randomized controlled trials (RCTs). This diverse methodological approach was selected to provide a comprehensive understanding of key outcomes, including the reduction of medication errors, improvements in workflow efficiency, and levels of satisfaction among physicians, pharmacists, and patients. The review was conducted in accordance with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines [7], using predefined inclusion and exclusion criteria**.**

2.2 Search Strategy

This study is a systematic review conducted in March 2025. Relevant data were sourced from several major electronic databases, including PubMed, Web of Science, ScienceDirect, and Scopus, focusing on articles published between January 2021 and March 2025. The search employed a combination of the following keywords: (1) electronic prescribing or e-prescription, **(**2) hospital, (3) medication error, and (4) service quality. Boolean operators “AND” and “OR” were used to optimize the search strategy across databases. In addition to database searches, a manual search was performed to identify any recently published or potentially overlooked studies, ensuring comprehensive coverage of the relevant literature.

2.3 Eligibility Criteria

We searched for eligible primary studies with full-text availability, published between January 2021 and March 2025. Only studies written in English were included, with no restrictions applied regarding study design, type, or country of origin. The screening and selection process was independently conducted by two reviewers. This review focused on randomized studies conducted in hospital settings, comparing electronic prescribing systems with traditional paper-based (handwritten) prescriptions. Included studies addressed both short- term and long-term impacts of e-prescribing, the use of routinely collected electronic prescribing data, and pharmacist involvement in system implementation. Eligible studies were required to report at least one relevant outcome related to the impact of e-prescribing on healthcare quality—specifically improvements in patient safety (such as reductions in medication errors), efficiency, user satisfaction, or patient satisfaction. A detailed list of inclusion and exclusion criteria is presented in Table 1.

Table 1. Inclusion and exclusion criteria

Criteria Type	Inclusion	Exclusion
Study Period	Studies published from January 2021 to March 2025	Studies published before January 2021 or after March 2025
Setting	Research conducted within hospital environments	Research conducted outside of hospitals (e.g., community clinics, pharmacies, or outpatient settings)
Focus Area	Studies assessing the implementation and use of electronic prescribing (e-prescribing) systems	Studies not specifically evaluating e-prescribing systems or those addressing general digital tools without focus
Outcomes	Studies reporting service quality outcomes, including: patient safety, efficiency, user satisfaction, patient satisfaction	Studies not reporting on service quality, or those focusing on outcomes unrelated to e-prescribing
Comparative Studies	Research comparing e-prescribing systems to conventional paper-based prescribing	Studies without a comparative analysis of prescribing methods (where relevant to the study aim)
Language	Articles published in English	Articles published in languages other than English
Study Type	Original research, including quantitative, qualitative, or mixed-methods designs	Review articles (systematic, narrative, or meta-analysis), editorials, commentaries, or conference abstracts

2.4 Data Extraction

The selection of articles followed the PRISMA 2020 (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flowchart [7]. Studies that did not fulfil the predefined criteria were excluded. The review process involved stages of identification, screening, application of inclusion and exclusion criteria, ultimately resulting in the final set of eligible articles. Data extraction was performed independently by the first reviewer through manual review of the selected studies. Extracted information included the authorship and publication year, journal name, study objectives, study design, setting, data collection methods, and key findings. This data was recorded using a standardized Microsoft Excel spreadsheet. To ensure accuracy and consistency, a second reviewer subsequently verified the extracted data.

2.5 Data Analysis

The data analysis in this systematic review employed a descriptive qualitative approach. Following the application of predefined inclusion and exclusion criteria, the selected studies were examined to extract information on their objectives, design, settings, data collection methods, key findings, recommendations, as well as their

strengths and limitations. Given the expected heterogeneity in study designs, outcome measures, and e-prescribing systems, a narrative synthesis was conducted to summarize and interpret the findings. This synthesis integrated evidence from diverse studies and highlighted common trends and notable variations in the implementation of e- prescribing across different countries and healthcare settings. The results were then organized into key thematic categories reflecting various dimensions of healthcare quality improvement associated with e- prescribing adoption.

3 Result

An initial total of 837 studies were identified through systematic searches of the PubMed, Web of Science, ScienceDirect, and Scopus databases. After removing 284 duplicate records, 553 unique articles remained. Of these, 530 were excluded following title and abstract screening, leaving 24 articles for full-text assessment. One article was excluded due to the unavailability of the full text. Additionally, a manual search of the reference lists of the full-text articles identified one more study, which was subsequently screened for eligibility. After a comprehensive full-text review, nine studies met the inclusion criteria. Including the additional manually identified article, a total of 10 studies were ultimately included in the final synthesis. The study selection process is illustrated in Fig. 1.

A total of ten studies met the inclusion criteria and were included in this systematic review. These studies were conducted in hospital settings across various countries and employed diverse research designs. Detailed data extraction outcomes are presented in Table 2. The methodological quality of each study was evaluated using the Joanna Briggs Institute (JBI) critical appraisal tools appropriate to the respective study design. Particular consideration was given to studies identified as having a high risk of bias during result interpretation. Specifically, five studies were appraised using the JBI checklist for quasi-experimental designs, three using the checklist for analytical cross-sectional studies, one using the Revised JBI checklist for randomized controlled trials (RCTs), and one using the JBI checklist for qualitative research. Quality assessments revealed that two studies achieved a score of 100 % (high quality), four scored 89 % (high quality), one scored 85 % (high quality), one scored 80 % (high quality), and two scored 75 % (moderate quality). Despite some limitations—such as lack of control groups, potential bias, and inadequate identification of confounding variables—all studies were considered suitable for inclusion in this review.

3.1 Patient Safety

A total of nine studies highlighted patient safety as a key positive outcome of electronic prescribing (e-prescribing) systems [1,8–15]. Patient safety, defined as the prevention of harm resulting from healthcare intended to aid patients, includes efforts to minimize medication errors through effective medication management. For instance, Aharaz et al. developed a Shared Medication Record prototype using participatory design, demonstrating its potential to enhance safety and reduce medication errors in patients with multimorbidity [8]. Almohammadi et al. reported a substantial decrease in

prescribing errors, particularly in missing dosage information, which dropped from 55.90 % to 4.29 %, and trade name usage errors, which declined from 50.49 % to 4.49 % [9]. Similarly, Sin et al. found that prescription error rates were reduced from 6.70 % to 3.90 % following e- prescribing implementation [10].

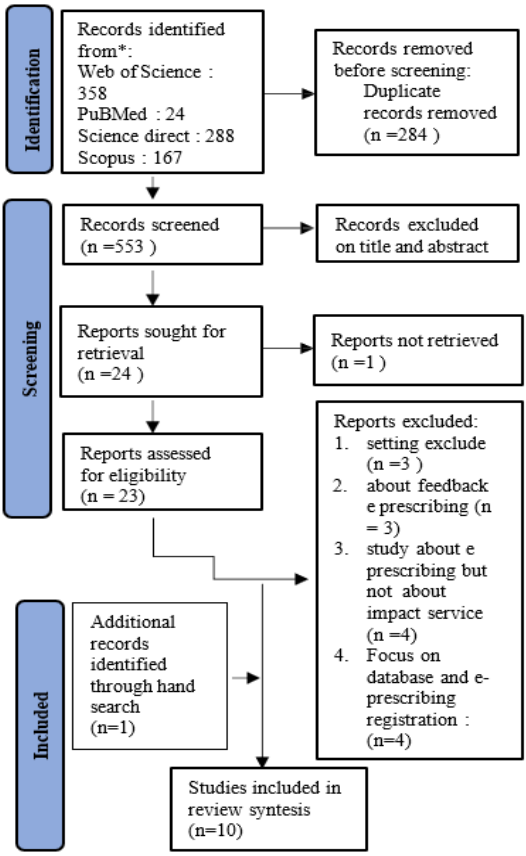

Fig.1. PRISMA flow diagram

Urtasun et al. observed notable reductions in prescribing errors across two hospitals—from 29.10 % to 19.90 % in a pediatric hospital and from 24.90% to 13.60% in a general hospital [11]. Linden-Lahti et al. also reported a decline in reported administrative and dispensing errors after implementing barcode scanning for medication preparation and administration using the APOTTI system [12]. Westbrook et al. noted a 36 % overall reduction in medication errors and a 33 % decline in high-risk medication errors after implementing an electronic medication management system (eMM) [13]. Channon-Wells et al. showed a reduction in antibiotic usage by 2.3 days of therapy (DOT) per 100 patient-days (PD) at University Hospital Southampton, and 0.8 DOT per 100 PD at Oxford University Hospital [14]. Ooi et al. highlighted that e-prescribing facilitates pharmacist intervention during the prescribing process, thereby enhancing medication safety [15]. Similarly, Alanazi et al. reported

that modifications through electronic prescribing significantly reduced prescribing errors by 49.80% [1]. Importantly, the use of e-prescribing eliminates risks associated with illegible handwriting, ensuring that prescriptions are communicated clearly and accurately. This improvement represents a critical advancement in patient safety.

3.2 Efficiency

Speed and efficiency are crucial elements in healthcare delivery, and the implementation of e-prescribing significantly enhances these aspects by streamlining the medication prescribing process. Through e-prescribing, patients experience reduced waiting times at pharmacies since prescriptions are transmitted electronically in advance. Muliati et al. reported that at RSUD Labuang Baji Makassar, 85.4 % of respondents perceived a faster waiting time due to e- prescriptions, while 14.6 % still experienced delays [2]. Aharaz et al. noted that e-prescribing enables healthcare providers to more quickly identify prescribed medications, with adjustments to Shared Medication Records (SMRs) facilitating improved patient safety and workflow efficiency [8]. Almohammadi et al. emphasized that electronic prescriptions allow pharmacists and the healthcare team to access patient diagnoses, aiding in verifying the appropriateness of prescribed medications [9].

Similarly, Sin et al. described how pharmacists can delay prescription verification if they identify prescribing errors, requiring physicians to amend prescriptions before validation [10]. Urtasun et al. highlighted that e-prescribing at a children's hospital improved dose estimation accuracy, with doses automatically calculated and displayed in mg/kg/day, simplifying dose monitoring [11]. Linden-Lahti et al. reported that the use of the APOTTI system enhanced documentation processes through structured information management [12]. Furthermore, Channon- Wells et al. demonstrated a significant reduction over time in the usage of antibiotics such as meropenem, piperacillin/tazobactam, teicoplanin, vancomycin, and gentamicin, particularly for piperacillin/tazobactam and vancomycin [14]. Poh Ling Ooi also identified e-prescribing as an effective alternative to optimize the ordering and administration of inpatient medications [15].

3.3 User Satisfaction

According to Aharaz et al., the Shared Medication Record (SMR) prototype enhances communication among healthcare professionals across different sectors as well as with patients. The redesigned interface offers a clearer overview of the diverse information within each patient's medication record, with new features guiding users to the most critical data[8]. Similarly, Marcella Urtasun et al. reported an 83 % compliance rate with electronic prescribing (EP), indicating good acceptance and appropriateness among users[11]. Healthcare professionals, including physicians and pharmacists, expressed positive perceptions of the e- prescribing system, noting that the drug information provided is relevant and supports clinical decision- making. They also emphasized the accuracy of electronic prescriptions in reducing prescription errors and the ease of reading prescriptions, which contributes to improved patient care through quality information delivery.

Table 2. Summary characteristics of included studies

Author and Year	Type of study	Setting	Data Collection Methods	Primary outcome	Secondary outcome
Muliati et al, 2024	Descriptive-analytic study with a quantitative cross-sectional approach	RSUD Labuang Baji Hospital, Makassar, Indonesia	Descriptive-analytic study with quantitative approach using questionnaire on 96 respondents.	The relationship between e-prescribing implementation and patient satisfaction in pharmaceutical services.	• Influence of drug waiting time and prescription accuracy on satisfaction. • Found significant impact of fast service time, but not of prescription accuracy.
Aharaz et al, 2023	A participatory design to develop a user-friendly prototype (Qualitative study)	Copenhagen University Hospital, Hvidovre, Denmark	Participatory design with user interviews and iterative prototyping.	Development of a user-friendly prototype of the national e-prescribing platform to improve patient safety.	• Identification of problems in the current system through participatory design. • Targeting reduced medication errors in multimorbid patients. • Improved communication between healthcare providers
Almoham madi et al, 2021	A pre-post study design	Jeddah City, Saudi Arabia	Pre-post interventional study; analysis of 1182 handwritten prescriptions (pre) and 1512 e- prescriptions (post).	Measurement of prescribing error reduction before and after e-prescription implementation.	• Breakdown of error types: undefined dosage form, trade name use, omission of route, etc. • Quantified handwriting-related error elimination.
Conor Ming-Ho Sin et al., 2021	A single-site, prospective, observational study	United Christian Hospital (UCH of Kowloon, Hongkong	rospective observational study (pre-post design) over two time points (March-April 2019 and 2020).	Change in prescribing error rate pre- and post-CPOE (Computerized Physician Order Entry) system implementation.	• Error characteristics analysis: type, cause, and frequency (handwriting vs. input errors).

Marcela Urtasun et al., 2022	Hybrid, descriptive, and quasi-experimental, before-and-after design	Buenos Aires Argentina	Hybrid quasi-experimental before-and-after design, plus survey on acceptability and adherence.	Effect of e-prescribing on prevalence of prescription errors in pediatric inpatients	• Measurement of user adherence (83%), acceptability, and suitability via surveys.
Lindén-Lahti et al., 2022	Quantitative analysis.	Helsinki University Hospital (HUS),Finlandia	Quantitative analysis of medication error reports (HaiPro system), qualitative content analysis of severe MEs.	Change in reported medication errors during and after EHR system (APOTTI) implementation.	• Breakdown of error types (administration vs. prescribing). • Identification of causes: user skills (55%), technical flaws (24%).
Samuel Channon-Wells et al, 2023	Retrospective study	United Kingdom	Retrospective analysis of antimicrobial use data (DOT per 100 patient-days) over 5 years at two hospitals.	Use of e-prescribing data to benchmark IV antibiotic use across two centers.	• Annual decline in antibiotic use (3.52 and 2.57 DOT per 100 patient-days). Identification of high-use drug classes (e.g., meropenem, vancomycin).
Poh Ling Ooi et al, 2021	A one-year retrospective, single-centre, cross-sectional study.	Northern Malaysia	Retrospective cross-sectional study analyzing 357,760 e-prescriptions over 12 months.	Rate and types of pharmacist interventions on electronic prescriptions.	• Prescriber acceptance rate of interventions (95.5%). Enhances collaboration between pharmacists and prescribers. Reduces prescription errors via pharmacist review.
Wafa K.	Retrospective quantitative study	Fahad Military Medical Complex, Saudi Arabia	Retrospective quantitative study analyzing error rates pre- and post-e-prescribing system modification across 29,554 admissions.	Reduction in overall prescribing errors after implementing the electronic prescribing system (e-prescribing) modifications.	• All healthcare professionals received uniform training, which helped standardise the transition and minimise learning-related errors in most areas.

These findings align with Kurniawati et al., who assessed e-prescribing system users at Magelang City Hospital, Indonesia, through interviews based on the Capability, Opportunity, Motivation, and Behavior (COM-B) Model. Pharmacists, as key users, demonstrated a favorable view of e-prescribing technology for enhancing their performance. However, they also highlighted the need for regular training of users, such as doctors and pharmacists, to optimize e- prescribing implementation. Overall, user acceptance and active organizational support are essential for the sustainable adoption of e-prescribing systems [16].

Table 3. Outcome measures explored by the included studies

Author and Year	Patient safety	Efficiency	User satisfaction	Patient satisfaction
Muliati et al, 2024		v		v
Aharaz et al, 2023	v	v	v	
Almohammadi et al, 2021	v	v		
Conor Ming-Ho Sin et al., 2021	v	v		
Marcela Urtasun et al., 2022	v		v	
Lindén-Lahti et al., 2022	v	v		
Johanna I. Westbrook et al, 2022	v			
Samuel Channon-Wells et al, 2023	v	v		
Poh Ling Ooi et al, 2021	v	v		
Wafa K. Alanazi et al, 2024	v			

3.4 Patient Satisfaction

The implementation of electronic prescribing (e- prescribing) systems has demonstrated a notable positive effect on patient satisfaction, largely driven by enhanced service efficiency and improved medication safety. A critical factor influencing patient satisfaction in healthcare is the timeliness and accuracy of medication delivery. E-prescribing allows prescriptions to be transmitted directly and electronically from physicians to pharmacies, thereby reducing waiting times and minimizing errors associated with illegible handwriting or manual transcription. Muliati et al. conducted a chi-square analysis using SPSS 27.0 to assess the association between e-prescribing implementation and consumer satisfaction. Their results showed a significant correlation between reduced medication waiting time and patient satisfaction ($p = 0.021$) [2]. This finding aligns with other research indicating that patient satisfaction scores are generally higher with electronic prescriptions compared to traditional methods [17].

Moreover, the clarity and accuracy afforded by e-prescribing enhance patients' trust and confidence in their treatment, particularly when medications are delivered promptly and appropriately in urgent situations. The decreased necessity for prescription clarifications or corrections further reduces patient waiting times, contributing to greater overall satisfaction with healthcare services. In summary, e-prescribing not only streamlines operational workflows but also fosters a patient-centered care environment. By simplifying the prescribing process and ensuring medication safety, it addresses core patient expectations for safe, efficient, and high-quality care. Collectively, these factors underscore the significant role of e-prescribing in advancing patient satisfaction across diverse healthcare contexts.

4 Discussion

Although the overall objectives and targets of the included studies are similar, there is considerable variation in their designs and contexts. Collectively, the findings indicate that the implementation of electronic prescribing (e-prescribing) significantly contributes to reducing medication errors, thereby enhancing patient safety. Notably, e-prescribing effectively decreases prescription-related errors, including those involving dosage, trade names, and duration [9]. However, challenges persist, primarily due to users' initial lack of familiarity and experience with the system. Adaptation to the e-prescribing system is necessary, which often delays the realization of its full benefits until approximately two years post-implementation [13]. These challenges can be mitigated through pre- implementation training and the provision of instructional modules to ensure users understand how to operate the system correctly.

Time efficiency is frequently reported as a key advantage of e-prescribing. Several studies highlight significant reductions in prescription processing time, especially in pediatric settings where the system automatically calculates and displays dosage based on entered prescriptions, thereby improving both time management and drug preparation accuracy [11]. Additionally, electronic prescribing facilitates more

effective antibiotic use control by enabling real-time monitoring of drug utilization data, which supports more efficient and regulated medication management [14].
Two studies further report increased user satisfaction with e-prescribing, attributing this to the system's design that provides comprehensive patient treatment information essential for effective care. E-prescribing also promotes interdisciplinary collaboration by allowing pharmacists to review and intervene in prescriptions that require modification, enabling doctors to make immediate corrections. This collaborative approach substantially reduces prescribing errors and improves patient care outcomes [15].

Overall, e-prescribing has a profound impact on reducing the time required to process prescriptions, leading to higher patient satisfaction due to shorter waiting times for medication services

5 Conclusion

This systematic review underscores the pivotal role of electronic prescribing in enhancing healthcare quality across various aspects. The adoption of electronic prescribing consistently proves effective in minimizing medication errors, especially prescribing mistakes, thereby significantly advancing patient safety. Additionally, the system improves healthcare efficiency by simplifying the prescribing workflow, shortening patient wait times, and enabling more precise dosage calculations. Electronic prescribing also fosters greater satisfaction among healthcare professionals—including physicians, nurses, and pharmacists—as well as patients, by supporting informed decision-making, ensuring clearer communication, and facilitating timely clinical interventions. Although initial challenges such as user unfamiliarity may arise, these obstacles can be effectively addressed through thorough training and system acclimatization. Overall, integrating electronic prescribing into clinical settings represents a transformative advancement toward safer, more efficient, and patient-focused healthcare delivery.

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