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Benefits and barriers associated with e-prescribing in community pharmacy – A systematic review

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ABSTRACT

Background: The utilization of electronic prescribing is growing, prompted by lockdown measures during the COVID-19 pandemic. However, despite this increasing adoption, there is a notable dearth of consolidated evidence regarding the challenges and opportunities associated with the integration of electronic prescribing systems within the daily clinical practices of community pharmacists.

Objective: This paper aims to systematically review the community pharmacists' perspectives on barriers and facilitators to electronic prescribing, addressing the significant need for understanding how electronic prescribing impacts the workflow and decision-making processes of pharmacists, ultimately influencing the quality of patient care.

Methods: PubMed, Embase, and Cumulative Index to Nursing and Allied Health Literature (CINAHL) databases were searched from January 1, 2000, to October 25, 2022, using search terms related to electronic prescribing, computerised physician order entry, community/retail pharmacies, and pharmacists.

Results: A total of 28 studies were included in the systematic review. In these studies, community pharmacists perceived that design, interoperability, attitude towards e-prescribing technology, information quality, workflow, productivity, and accessible resources facilitated e-prescribing. In addition, the included studies emphasized the importance of technological support for the successful implementation of electronic prescribing systems. The system's design characteristics significantly improve e-prescribing technology's favourable effects. According to our review, it has been proposed that a poorly designed e-prescribing system can have a negative impact on the quality of care, implementation, and user satisfaction. In contrast, a well-designed system can significantly contribute to improvements.

Conclusions: The review highlighted that e-prescribing has both barriers and facilitators, with the quality of the system and its implementation influencing these factors. Technical issues and user acceptance (patient/prescribers/pharmacists) can act as barriers or enablers, highlighting the need for comprehensive consideration and monitoring of e-prescribing to identify and address potential issues.

1. Introduction

Ensuring patient safety and providing high-quality care requires accurate and complete patient information, which can often be challenging due to the fragmented nature of health settings. To address this, there is a need for innovative technologies to manage patients' health records better and support medical decision-making.[1] Implementing digital health services (telehealth, electronic health records, remote monitoring) and technologies (wearable health trackers and health applications) has revolutionised healthcare delivery, focusing on safety, quality improvement, privacy, and confidentiality.[2] These new technologies have emerged as a response to traditional methods' limitations and can potentially improve clinical care.[3]

During the 2019 coronavirus pandemic (COVID-19), there was a greater need to modify how general practices provide healthcare due to the demand for social distancing. This led to an increase in telehealth services, expedited electronic prescribing and home delivery of medications to support vulnerable individuals and reduce the transmission of COVID-19 infection among patients and healthcare providers.[4] Electronic prescriptions emerged as one of the crucial digital health

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innovations that played a critical role in ensuring uninterrupted healthcare services during the pandemic. For example, the number of electronic prescriptions in the United States increased to 1.91 billion in 2020, while telehealth consultations increased by 154% compared to March 2019.[5] By May 2020, nearly all general practices in England provided telehealth services, with 80% of prescriptions going paperless.[6] Similarly, in Australia, there has been a significant increase in the utilization of telehealth services and electronic prescriptions. Between March 13, 2020, and July 31, 2022, approximately 118.2 million telehealth services were delivered to 18 million patients. Moreover, over 95,000 practitioners utilised telehealth, and between May 2020 and March 2023, around 130 million electronic prescriptions were issued.[7,8]

E-prescribing is an essential aspect of modern healthcare systems and has been adopted by many countries worldwide to improve the quality, safety, and efficiency of medication management. *E*-prescribing is a process whereby healthcare professionals, such as doctors or nurse practitioners, use a secure electronic system to create, transmit and store patient prescription information.[9] Rather than traditional paper prescriptions, e-prescribing enables healthcare professionals to electronically generate and send prescriptions directly to pharmacies, where they can be quickly and accurately filled.[10] *E*-prescribing systems can also provide healthcare professionals with up-to-date information on medication interactions, allergies, and dosing guidelines, reducing the risk of medication errors and improving patient safety.[11]

Electronic prescriptions have revolutionised prescription handling, leading to significant advancements in healthcare systems. They are recognised as a crucial reform in pharmaceutical policies worldwide, with evaluations conducted across multiple countries in recent decades.[12] In countries like Australia, from 2020 to 2021, >314.8 million prescriptions were dispensed under the Pharmaceutical Benefits Scheme and Repatriation Pharmaceutical Benefits Scheme[13]; medication errors have been identified as a significant public health issue, causing 250,000 medication-related hospital admissions and an annual cost of AUD 1.4 billion to the healthcare system.[14] Similarly, in the United States, the Centres for Disease Control and Prevention (CDC) reported that nearly half of the population used at least one prescription medication within 30 days from 2015 to 2018.[15] The annual cost of medication errors is estimated at $40 billion.[16] Nearly two-thirds of Canadians over 65 take at least five distinct prescription medications, with medication errors resulting in 1 in 143 hospitalisations and costing an estimated CAD 140 million annually.[17] Meanwhile, England reported that approximately 1.1 billion prescription items were dispensed in the community, with preventable medication errors costing the National Health Service approximately £98.5 million annually and contributing to approximately 1700 fatalities.[18] These statistics from Australia, England, USA and Canada show that medication errors are a serious problem that can significantly impact public health and healthcare costs.[14,16–18] *E*-prescription benefits patients in two ways. Firstly, it minimizes the chances of prescription misplacement or loss. Secondly, it reduces the dispensing time, leading to shorter wait times and higher satisfaction levels with pharmacies.[19,20] Electronic prescriptions can streamline the dispensing process at pharmacies,[21] reducing the need for clarification calls, speeding up refill operations, maintaining organised data, and providing updated information on pharmaceutical formularies and pre-authorisations.[22] In essence, e-prescribing services aim to enhance patient access to medications and bolster the efficiency and efficacy of healthcare services, positioning it as a pivotal component of contemporary healthcare systems.[23]

Digital health technologies have transformed the healthcare industry by improving the planning, organisation, and delivery of services. However, the success and sustainability of these technologies largely depend on user satisfaction.[24] As community pharmacists are the primary users of e-prescribing applications, their input is critical for improving the effectiveness and efficiency of the process. Therefore, evaluating their satisfaction with this service is crucial to ensure optimal care delivery.

This systematic review aims to explore the experiences of community pharmacists with electronic prescribing systems, focusing on their daily use and the associated barriers and facilitators. By using the Theoretical Domains Framework (TDF) to analyse the data in-depth, we aim to identify factors that influence the implementation and use of these systems. Ultimately, this review aims to provide insights that can be used to improve the efficacy and user experience of e-prescribing systems, thus enhancing patient care and medication management.

2. Methods

2.1. Protocol and registration

This study was conducted according to PRISMA guidelines for systematic review.[25] The protocol for this systematic review was registered with PROSPERO International Prospective Register of Systematic Reviews (registration number: CDR42022370501). It is available at: [https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42022370501].

2.2. Eligibility criteria

To be included in the review, studies had to:

1. Be original research articles published in English and subjected to peer review.
2. Report on community pharmacists' perspectives regarding e-prescription or computerised physician order entry systems. In cases where multiple stakeholders, such as physicians, pharmacy personnel, and nurses, were involved, community pharmacists' perspectives had to be distinctly highlighted and included.

The exclusion criteria were as follows:

1. Non-original articles, including review articles, grey literature, and studies published in languages other than English.
2. Articles that did not include the community pharmacist's perspective.
3. Studies exclusively focused on secondary and tertiary care settings within hospitals.
4. Studies where the full text was unavailable.

2.3. Search strategy

A complete literature search was conducted on the following databases: PubMed, Embase and Cumulative Index to Nursing and Allied Health Literature (CINAHL) databases from January 1st, 2000, to October 25, 2022, in order to focus on contemporary systems. We conducted a comprehensive search using a combination of relevant keywords and MeSH headings, such as "e-prescription," "e-prescribing," "computerised physician order entry," and "community/retail pharmacies and pharmacists," to identify relevant studies. Both OR and AND Boolean operators were utilised to combine these terms. In addition, we manually searched the reference lists of eligible studies to identify any relevant articles that may have been missed during the electronic database search. Please refer to Table S1 in the Supplementary Material document for the detailed search strategy.

2.4. Study selection

All identified studies were imported into Endnote, and duplicates were deleted. Two investigators independently screened the title and abstracts and then reviewed the full text of potentially relevant studies. Any discrepancies were resolved through discussion with other investigators.

2.5. Data extraction

Two investigators independently extracted data from the selected studies through manual extraction. Extracted data includes study design, country of origin, year of publication, study focus, study setting, participants, and outcomes regarding barriers and facilitators to e-prescribing services. The data related to barriers and facilitators were systematically analysed and categorised according to the domains of the Theoretical Domains Framework (TDF),[26] which provides a comprehensive and structured approach to understanding the factors influencing behaviour change in healthcare settings. This mapping process involved identifying the relevant TDF domains that each barrier or facilitator aligned with, thus enabling a more nuanced and in-depth analysis of the underlying factors impacting the uptake and implementation of e-prescribing systems by community pharmacists.

2.6. Quality and risk of bias assessment

Two investigators independently assessed the quality of each included study using Mixed Method Appraisal Tools (MMAT) for qualitative, quantitative, and mixed-method studies.[27] Each paper was evaluated using the MMAT quality appraisal tool, and a score was

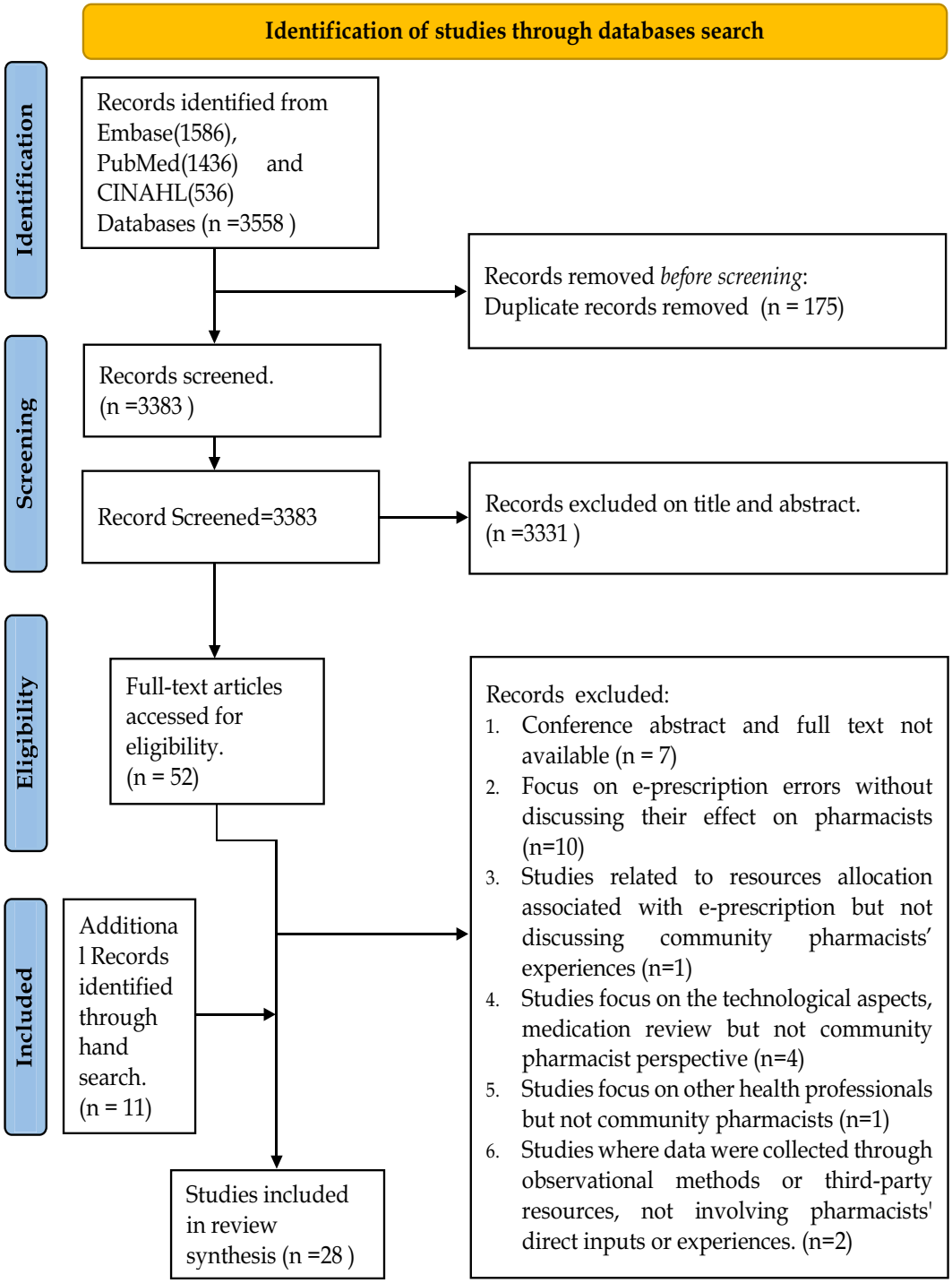

Fig. 1. PRISMA flow diagram.

assigned based on the percentage of criteria that were met for the relevant study design. For example, if the paper met 4 out of 5 criteria, it was assigned a score of 80%. Three sets of criteria (qualitative, quantitative, and mixed methods) were used for mixed methods studies to determine the final score. We assessed the quality of the included studies to ensure that they were methodologically rigorous and relevant to our research questions. We examined the research design, sampling strategy, data collection methods, data analysis techniques, validity and reliability measures for each study. For mixed methods studies, we evaluated how qualitative and quantitative data were integrated and complemented each other. The quality assessment provided valuable insights into the strengths and limitations of each study, contributing to the overall credibility and validity of our research synthesis.

3. Results

3.1. Article selection

A total of 3558 studies were initially retrieved through the database search, which were reduced to 3383 articles after removing duplicates ($n = 175$). Among these, 3331 records were excluded based on title and abstract, resulting in 52 articles that could be considered for inclusion. A manual search of the reference lists of full-text articles led to an additional 11 papers that were screened for eligibility. After a thorough review of the full-text articles, a total of 28 relevant papers were included for synthesis, as shown in Fig. 1. Please refer to Table S3 in the Supplementary Material document for the list of excluded articles.

3.2. Assessment of quality

All 28 papers were assessed using at least one of the study designs listed in the MMAT.[27] The most common criteria used to evaluate the quality were questions pertinent to a qualitative study (15/28), followed by quantitative studies (9/28) and mixed method studies (4/28). Most studies (25 out of 28) demonstrated strong methodological quality, meeting the predefined standards and guidelines. These studies provided robust and reliable evidence for our research synthesis. No paper was excluded from the review based on its quality. A summary of the quality assessment results can be found in Table S2 in the Supplementary Material document to enhance transparency.

3.3. Study characteristics

The characteristics of the included studies are summarised in the data extraction table (Table 1). The studies included in this review were published between 2007 and 2021. Most of the included studies (32%) were carried out in the United States of America (USA) ($n = 9$). European countries, including England, Sweden, Belgium, and Finland, accounted for 39% of the studies ($n = 11$). Canada was the location for 17% of the studies ($n = 5$), while New Zealand contributed 4% of the research (n = 1). One study was conducted in Turkey (4%) and another in Malaysia (4%). Seven research papers (25%) reported the outcomes of studies involving pharmacists and physicians. Conversely, twenty-one (75%) articles centred on research exclusively involving community pharmacists, with the potential inclusion of pharmacy staff. Out of the 28 studies analysed, 53% were carried out using a qualitative research method ($n = 15$),[28–42] 33% studies incorporated a quantitative approach ($n = 9$),[43–51] while 14% of the included studies utilised mixed method design ($n = 4$).[52–55]

3.4. Key findings

A comprehensive overview of the study's findings is shown in 4 tables. Table 1 presents the data extraction details for all included studies. Table 2 depicts the overall e-prescribing exchange process of the countries included in this systematic review. Tables 3 and 4 describe the barriers and facilitators of e-prescribing identified in each study, including their TDF domains. Through data extraction and tabulation, community pharmacists' perspectives on the factors influencing their experience with e-prescribing systems were identified. Facilitators refer to factors that support the successful integration and use of electronic prescribing, as reported by the included studies. In contrast, barriers in our review are the elements that negatively impact pharmacists' interactions with the electronic prescribing system. The collected data on facilitators and challenges were subsequently mapped to the Theoretical Domains Framework (TDF) for classification and analysis.[26] All authors analysed the mapping of domains to the TDF and reached a consensus on the most accurate categorisations. This rigorous approach ensures a comprehensive analysis of the factors influencing community pharmacists' experience with e-prescribing and provides valuable insights for optimising e-prescribing practises in community pharmacy settings.

3.5. E-prescribing process

Electronic prescribing systems can vary across countries. In the United States, some systems allow prescribers to request patients' medication history and formulary information directly from pharmacies and reimbursement authorities. A central repository is used in Canada and England, but prescribers may need to manually enter the patient's information. Within the scope of this review, in the countries under consideration, prescribers enter prescription details into their clinical system, which checks medication history and drug allergies. Prescribers sign the prescription electronically, and it's securely transmitted to the patient's preferred pharmacy or a designated one directly or via an intermediatory, with confirmation sent to the prescriber once the medication is dispensed. Table 2 summarises the e-prescribing processes for the studied countries.

3.6. Barriers to e-prescribing

A total of twenty-five papers discussed the barriers to the e-prescribing process (Table 3). Barriers were mapped to the following eight TDF domains. Environmental context and resources accounted for the highest proportion, representing 50% of the studies,[28,29,32,33,35,36,41–46,52–54] followed by knowledge 11%,[41,53,54] professional role and identity 3%,[31] social influence 7%,[31,41] interpersonal and professional relationship 14%,[31,34,41,42] belief about consequences 18%,[41,42,44,47,55] memory attention and decision Process 7%,[34,55] belief about capabilities 3%,[43] and reinforcement 7%.[53,55] It's important to note that the percentages may exceed 100% due to some studies addressing multiple domains within their discussions of barriers.

3.7. Facilitators to e-prescribing

A total of 17 papers discussed the facilitators to the e-prescribing process (Table 4). Facilitators were categorised into the following six TDF domains. 3% of the studies accounted for social professional role and identity,[30] 57% accounted for environmental context and resources,[30,32,33,35–38,40–45,51,54,55] 35% accounted for belief about consequences,[30,36,40,41,43,45,50,51,54,55] 17% accounted for interpersonal and professional relationship,[35,40,41,43,54] 14% accounted for knowledge and skills.[35,41,48,49] It's important to note that the percentages may exceed 100% due to some studies addressing multiple domains within their discussions of facilitators.

4. Discussion

From the pharmacists' perspective, the most frequently referenced barrier to e-prescribing is associated with the environmental context and resources domain of the TDF framework. The facilitators most frequently referenced were, again, environmental context and resources, suggesting that focused rather than multi-faceted interventions would

Table 1
Representing data extraction details.

First Author Time Country	Study Design(Data Collection method)	Research focus	Participants	Barriers	Facilitator	Analysis technique
Gagnon et al. [28] (2015) Canada	Qualitative design (telephone and in-person interviews)	The study focus was barriers and facilitators concerning the adoption of nationwide e-prescribing implementation	33 community pharmacists, 2 pharmacy technicians, 11 physicians and 3 clinic managers	• Lack of data standardisation • Lack of interoperability • Lack of training /technical support by the software provider • In the early stages of e-prescribing network implementation, many pharmacies were connected to the network, but very few physicians were. This led to a shortage of prescriptions in the e-prescription warehouse and its underutilization by pharmacists. • The requirement for a paper prescription as the only legal document in the e-prescribing process was a significant barrier. This meant patients had to bring their paper prescriptions to the pharmacy, even when an electronic version was available through the network. It also legitimized manual prescription processing based on the information found on the paper prescription.	• Pharmacists liked that information from their pharmacies was automatically sent to the national warehouse of medication records. They also liked how easy and valuable using the drug history warehouse was. • The nationwide medicine history warehouse data helped pharmacists fill out patient files and find possible drug abuse problems. • Community pharmacies had already computerised their local work setting and often used electronic local pharmacy software, which made it easier for them to use the e-prescribing network.	• Qualitative data analysis (NVivo, CDF framework for codification)
Motulsky et al.[52] (2019) Canada	Mixed method-Descriptive analysis+ exploratory descriptive studies (Interviews and observation)	The focus was on adoption issues.	There were 11 pharmacists, 8 pharmacy technicians, 9 prescribers, 7 physicians and 2 nurses.	• Increase stationary cost. • Despite the availability of e-prescriptions, pharmacies frequently begin with a paper copy due to a lack of notifications or alerts when an e-prescription is available for a patient. • Problems with the auto-population of prescription fields and more frequent manual adjustments are necessary for various prescription fields, indicating a lack of standardisation and the possibility of errors. • Absence of a visual representation of the original e-prescription During the validation process, the lack of an original, unmodifiable version of the e-prescription can result in potential errors. • The absence of visual aids or codes to group medications associated with the same order causes confusion and inefficiency in the interface for selecting medication orders. • Lack of standardisation	• Not applicable	• Descriptive analysis + exploratory studies (thematic analysis)

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Table 1 (*continued*)

First Author Time Country	Study Design(Data Collection method)	Research focus	Participants	Barriers	Facilitator	Analysis technique
				• Auto-population of prescription field • Implementation issue (low adoption by prescribers) • Lack of visual representation of the original prescription in the validation step (risk of error) • Limitations on the importation of medications in bulk as not all systems permit the importation of medications in bulk, resulting in inefficiency and superfluous manual tasks. • The adoption of e-prescribing features (electronic transmission) is lagging. • Despite the potential benefits of e-prescribing, its adoption and effective use are hampered by several issues related to system design, workflow integration, standardisation, and safety features. • One Pharmacy Management System (PMS) lacked a non-editable version of the electronic prescription, creating a risk for errors due to undetectable manual changes. • Pharmacy staff generally found processing paper prescriptions faster and easier.		
Motulsky et al.[29] (2015) Canada	Qualitative Method (Interviews)	The focus was on adoption issues	49 participants, including 12 G. P.s, 2 managers, 33 community pharmacists, 2 pharmacy staff members	• Integration issues • Central warehouse structure (manual caparison required) • Problems arise when importing prescriptions like pharmacy systems automatically add instructions. • Manual processing of e-prescription using a paper script • Unstructured data, issues with the automatic discontinuation of old prescriptions, and inefficiency in detecting changes or errors. The electronic prescriptions were transmitted using a pull model, which required the pharmacy staff to wait for the patient to present the paper prescription before importing it	• Not applicable	• Qualitative analysis (Verbatim transcripts were analysed through thematic analysis)
Motulsky et al.[30] (2008)	Qualitative Study (Interviews)	The focus was to determine e-prescribing technology's effect on	12 community pharmacists	• Legally and ethically, pharmacists are required to validate the prescription details for	• Facilitate easy prescription processing. (The benefits of e-prescription heavily depend on how well	• Qualitative analysis (software ATLAS·Ti for the coding, Patton's

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Table 1 (*continued*)

First Author Time Country	Study Design(Data Collection method)	Research focus	Participants	Barriers	Facilitator	Analysis technique
Canada		pharmacists' professionalisation		the product provided to the patient, which could increase the time needed to execute a prescription using an e-prescription.	physicians utilise the system. Misuse can lead to prescription errors and increased time spent on verification and correction by pharmacists.) • Enhance information quality. • Boost the professionalisation of pharmacists. • Increase analytical capacity. • Raise the relevance of pharmacists' intervention. • Give awareness to physicians about pharmacists' contribution. (Some pharmacists predict that using expert software or access to comprehensive pharmacotherapeutic records will enhance physicians' understanding). • Enhance professional judgment skills. • Being safe for patients • Reduce pharmacist's workload.	procedure for codebook)
Motulsky et al.[31] (2011) Canada	Qualitative study (interviews)	The focus was to determine disruption in the pharmacist's professional role by electronic prescribing technology	21 participants, including 14 community pharmacists and 7 G.P.s	• Disrupt the jurisdiction of community pharmacists by changing the distribution of information among G.P. and pharmacists. • Pharmacists do not always have access to complete patient data, including clinical history and physical examination results, limiting their ability to make informed decisions about medication. • Tension between pharmacists and physician • Physicians are reluctant to give access to pharmacists for a therapeutic indication as they are concerned about whether pharmacists have the necessary training to interpret additional clinical data correctly. • Some pharmacists show concerns that they may be liable for improper use of patient data, such as lab results. • It is debatable whether computerising the transfer of prescriptions is efficient, as pharmacists must frequently manually evaluate and correct the data.	• *E*-prescription technology and prescription computerisation can help pharmacists interpret therapeutic projects by giving standardised and unambiguous drug information. • Better access to therapeutic Indications helps pharmacists analyse patient files and decrease judgment mistakes by providing context for why medicine was given. • Minimise handwriting errors, saving time on clarifications and reducing errors, enhancing patient safety. • Potentially offers more efficient prescription entry and transfer, thus reducing time spent on technicalities and allowing pharmacists to focus more on patient care.	• Qualitative analysis (verbatim transcripts were generated, ATLAS·Ti software and Patton's procedure for codebook and analysed using grounded theory approach)
Clauson et al.[43]	Quantitative (Surveys)	The study focus was to determine pharmacists'	438 community pharmacists	• Perceived cost • resistance in acceptance to new technology (age	• Saving time (partially positive)	• Multiple regression analysis (Binary

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Table 1 (*continued*)

First Author Time Country	Study Design(Data Collection method)	Research focus	Participants	Barriers	Facilitator	Analysis technique
(2011) United States of America		perception regarding e-prescribing		specific = experienced pharmacists may have less interest in a new approach such as e-prescribing)	• Faster provision of service to the patient • Improving patient safety (reduced medication errors, reduced data entry errors) • Chain pharmacy (more likely to implement e-prescribing)	logistic regression + *t*-test) • The regression model used for analysing pharmacist adoption of e-prescribing included various factors such as saving money, improving patient safety, improving health outcomes, timesaving, perceived cost, time-consuming, technology acceptance, years in practice, gender, age, pharmacist role, pharmacy practice type, and volume of prescription.
Odukoya et al.[32] (2012a) United States America	Qualitative (think-aloud protocol + observation)	The study focus was to determine the community pharmacists' staff perception of e-prescription design	7 pharmacies, including 10 pharmacists and 24 technicians.	• Differences in pharmacy and prescriber systems sometimes result in wrong patient selection. • The Drawbacks of e-prescription design (mismatched text box sizes, mismatched drug names, mismatched patient/physician names, mismatched drug quantities, and inability to discontinue old prescription).	• Improve legibility. • Consistent sequences • Ease of archiving • Reduced time in retrieving old prescriptions, consistency in e-prescription format.	• Qualitative thematic analysis
Odukoya et al.[33] (2012b) United States of America	Cross-sectional Qualitative (think-aloud protocol + pharmacy group interviews)	The study focused on determining the workflow challenges encountered while using e-prescribing technology.	7 community pharmacies (16 pharmacists and 14 pharmacy technicians)	• System (prescribing software) related factors affecting workflow. • Confusing or inaccurate e-prescriptions • Delay in receiving prescription (transmission issues) • Time delay and bundling • lack of training • e-prescription design presented on pharmacy system. • Lack of formal training	• Reduced workload (when problem-free) • Streamline workflow (when problem-free)	• Qualitative thematic analysis
Odukoya et al.[34] (2013) United States of America	Cross-sectional Qualitative design (Direct observation + Think Aloud Protocol + Team interviews)	The study focused on determining the factors that may increase the potential for medication errors with e-prescribing.	7 community pharmacies(14 pharmacists and 16 Technicians)	• increase cognitive burden(high amount of memorization is required to fill e-prescription • communication issues with patients, prescribers, and pharmacy personnel • interruptions during the dispensing process • receive erroneous e-prescriptions daily	• Not applicable	• Qualitative thematic analysis
Odukoya et al.[35] (2015b) United States of America	Cross-sectional Qualitative Design (direct observation + interviews+ focus group)	The study focus was to determine the factors affecting e-prescribing error recovery	5 Community pharmacies (13 Pharmacists, 14 Pharmacy Technicians)	• Lack of training and experience • Lack of knowledge • Interruptions in the surrounding environment • External factors like insurance policies • Poor visibility of e-prescription information • Duplication of patient's profile on new prescription arrival	• Sufficient training and experience • Good clinical drug knowledge • Environmental conditions like adequate lightening, appropriate temperature, consistent workflow layout • Clinical decision support (drug utilization review alert) • Adequate and accurate communication between prescribers and pharmacists	• Qualitative thematic analysis

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Table 1 (*continued*)

First Author Time Country	Study Design(Data Collection method)	Research focus	Participants	Barriers	Facilitator	Analysis technique
				• Time pressure is created due to the backlog or slow system response. • Overreliance or complacency with the technology to detect errors. • Organisational factors like communication breakdown, pharmacy staff training and insufficient staffing level.		
Rupp et al.[44] (2007) United States of America	Descriptive cross-sectional Quantitative (Questionnaire)	Study findings focussed on the attitude and beliefs towards e-prescribing and the processing of e-prescription	1086 participants, including 446 pharmacists, 605 technicians and 35 interns	• Prescribing errors, • delay in receiving e-prescription technical problems (slow system response) • communication issues with prescribers and patients • e-prescription lost or sent to the wrong pharmacy. • e-prescription containing inaccurate information (insufficient or incomplete) • No alert system within the system • e-prescription not allowed for controlled substances (split prescription)	• Improved legibility/clarity • improved efficiency +reduced interruptions (decreased workload) • increased prescription integrity/security	• ANOVA • Regression analysis
Grossman et al.[36] (2012) United States of America	Qualitative study (Interviews)	The study focused on identifying facilitators and barriers to electronic transmission and e-prescription processing.	97 facilities, including 24 physician practices, 48 community pharmacies, and three mail-order pharmacies	• The complexity of prescription routing • Transmission issues (but actual transmission failure is a rare event) • Transaction fee associated with renewal authorisation request (still faxing renewals) • Pharmacists are not able to change drug formulation to make it cost-effective for the patients (physicians need to prescribe formulation rather than just drug) • Reconciling prescription data fields between practice and pharmacy system • The electronic renewal process was not consistently utilised, leading to inefficient workarounds for physicians and pharmacists. • Inappropriate quality of patient instruction (system-related issue); therefore, staff had to edit specific fields. • Lack of training	• Overall satisfied with the electronic transmission feature of e-prescribing technology. • Improvement in efficiency • Time-saving in dispensing processes like electronic renewals. • Reduced manual prescription entry	• Qualitative thematic analysis
Lander et al.[53] (2012) United States of America	Mixed method (open-ended and structured questionnaire, interviews over telephone)	Study findings focus primarily on impediments to e-prescribing system adoption.	23 Pharmacies, including 11 pharmacists, 10 owner/ pharmacists, 2 pharmacy managers	• Costs associated with e-prescribing, such as startup fees, transaction fees, and ongoing maintenance fees, were cited by pharmacists as the most prevalent barrier. Customers' and prescribers' lack of	• Not applicable	• Fisher exact test

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Table 1 (*continued*)

First Author Time Country	Study Design(Data Collection method)	Research focus	Participants	Barriers	Facilitator	Analysis technique
				demand or interest was also cited as a significant factor impeding their implementation by the pharmacists. • Concerns about potential disruptions to existing workflows and dissatisfaction with their current system were expressed by some pharmacists. This indicates that e-prescribing must be better integrated into existing pharmacy processes to minimise disruption. • Many pharmacists who had no intention of e-prescribing cited the new system's steep learning curve and prescription error concerns. This highlights the significance of comprehensive training and ongoing support in boosting pharmacists' confidence and proficiency with e-prescribing systems. • There appeared to be a correlation between pharmacies planning to e-prescribe and the presence of competing pharmacies or local physicians already sending e-prescriptions. This suggests that external pressures and expectations may influence pharmacists' attitudes towards electronic prescribing.		
Terri et al.[41] (2011) United States of America	Qualitative Studies Focus Group	Focus on pharmacists' opinions and perspectives regarding utilising Health Information Technology (HIT), including Electronic Prescribing (eRx).	32 pharmacists participated from the following care settings: 19 retail, 3 hospitals, 4 outpatient care, and 6 others	• The study highlighted the risk of selection errors in the drop-down menus of e-prescription systems, indicating a potential problem with the interface or user experience. • The pharmacists suggested that insufficient training of physician delegates in using e-prescription systems could potentially lead to mistakes and inefficiencies. • A lack of training and knowledge in e-prescription software among pharmacists was seen as a potential barrier to its practical use. • The patients might have unrealistic expectations regarding the speed of e-prescribing and processing, which could lead to dissatisfaction.	• Decreased errors • Improved Data Accuracy • With the implementation of e-prescription, pharmacists saw the potential for expanded opportunities in their clinical practice. • E-prescribing could increase efficiency in the prescription process, leading to better time management and patient service. • e-prescription was seen as a potential avenue for improved communication between pharmacists and prescribers, which could positively impact patient care. • Improved Formulary Compliance	• Descriptive coding was used for demographic characteristics. • Analytical coding was used to assess responses. • Post coding produced counts. • Recoding and consistency checking were done for quality control.

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Table 1 (*continued*)

First Author Time Country	Study Design(Data Collection method)	Research focus	Participants	Barriers	Facilitator	Analysis technique
				• Similarly, physicians might have a false expectation that e-prescribing would significantly reduce calls from the pharmacy, potentially leading to communication gaps. • Legal hurdles related to the e-prescribing of controlled substances could act as a significant barrier. • Time Management, Technology Problems, and Transaction Costs • *E*-prescription potentially reduces patient involvement in the process, which could be detrimental to the pharmacist-patient relationship.		
Rahimi et al.[45] (2011) Sweden	Cross-sectional Quantitative (survey)	The study examines the e-prescribing impact on pharmacists' practice concerning work efficiency and pharmacological safety	52 community pharmacists	• System-related issues (system unavailability) • System dependency • Loss of working hours	• Better access to patient information • Faster prescription processing • Reduce calls due to prescription ambiguity. • Improved work efficacy • User friendly • Safe for patient • Improve legibility. • Reduce prescription errors	Descriptive analysis t-test correlation between area indices analysed using Spearman correlation
Hammar et al.[54] (2010) Sweden	Mixed method (Survey)	The study evaluated Swedish pharmacist attitudes towards e-prescribing technology	259 community pharmacists	• Inconvenient to make changes. • System-related problem • The physician uses different supply registers. • Difference in abbreviations • Duplicate e-prescription • Patient/prescriber unawareness of e-prescribing • problem with patients without a social security number	• Safe for patients • Improve legibility. • Less falsification • Save time. • Convenient for patients • Computerised tool or related services(online medication review) • Better communication between patient and prescriber • Improve patient quality of care. • Being cost-effective	• X^2 Test • Free-text answers were analysed and categorised based on the most mentioned opinions, with categories emerging during the analysis and being divided if necessary.
Franklin et al.[46] (2013) England	Exploratory Quantitative Data collection form)	This study compared the number and type of interventions made by community pharmacists using EPSR2 with those originating from prescriptions without EPSR2.	8 community pharmacies	• Miscommunication as patients expect electronic prescriptions (EPSR2) at the pharmacy, but sometimes the prescription is still on paper at the GP surgery. • Automatic Transfer of Instructions - EPSR2 automatically transfers dosage instructions onto the medication label, leading to issues when instructions are unclear or use abbreviations that need manual edits by pharmacy staff. • Missing Prescriptions Occurrences of prescriptions not found at the pharmacy despite being informed of electronic transmission, necessitating faxing the prescription from the GP surgery.	• EPSR2 reduced the number of prescriptions in circulation that are unsigned. • This reduces the workload for the pharmacy. • Minimizes patient inconvenience	• Descriptive analysis

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Table 1 (*continued*)

First Author Time Country	Study Design(Data Collection method)	Research focus	Participants	Barriers	Facilitator	Analysis technique
				• Incorrect Setup Errors in setting up community pharmacy nominations led to missing prescriptions. • Incomplete Prescriptions Instances of incomplete EPSR2 prescriptions with no visible dose on the screen		
Jasmine et al.[37] (2011) England	Qualitative (interviews+ nonparticipating observation)	The study examined how the enhanced EPS (EPS2) can affect workflow and workload in community pharmacies.	8 Community pharmacies, including community pharmacists and other staff	• Printing token (maintain safety practice) before dispensing (affect workflow) • Increase stationary cost. • Require more dispensing terminals to work efficiently	• It can provide value to the overall dispensing process. • Enhance workflow. • Improve task management.	Qualitative methods were employed that used an ethnographic framework.
Sara et al.[40] (2013) England	Qualitative (interviews)	This study explored pharmacists' experience with the new system and their perceptions of its benefits and any. associated problems.	13 community pharmacists	• System problems • split prescriptions • missing prescription • codes unrecognisable • problem with nomination • the problem associated with smart cards. • a large amount of printing • mixed way of working • time, • difficulty with supplementary prescribing • time-consuming • Transmission issues	• Being safe for patients • Reduced pressure from a more even workflow • Reduced dispensing time. • Encouraged communication. • Strengthened relationships due to shared problem-solving. • Reduced medication owing • Improved relationships with patients and physicians.	• The transcribed interviews were subjected to coding using the grounded theory's four stages.
Jasmine et al.[38] (2014a) England	Qualitative (interviews + observation)	This study explored community pharmacists' initial perceptions of the advanced version of the Electronic Prescriptions Service in England	8 community pharmacies	• Missing prescription (unsigned prescription) • System-related issues (transmission issues)	• Streamlining pharmacy workflow • Reduced waiting time • Useful for processing bulk prescriptions • Aid repeat dispensing	• Qualitative data from interviews were analysed through line-by-line coding. Field notes were analysed thematically.
Jasmine et al.[39] (2014b) England	Qualitative (interviews + observation)	The study aimed to explore initial user experiences of Community Pharmacists using EPS2 in England.	8 community pharmacies	• Missing prescription (disrupting work practice) • Long-term design-specific issues (community pharmacists have been involved in the initial development). • Problematic interface causing issues with endorsing prescriptions and claiming reimbursements. • Using one smartcard to log all dispensing activities (Users cannot share Smartcards or access sessions.)	• Not applicable	• Qualitative data were analysed through line-by-line coding and thematic analysis, identifying positive and negative themes related to usability and user experiences for a bottom-up analysis.
Van Laere et al.[49] (2020) Belgium	Descriptive Cross-sectional Quantitative study (survey-based)	This study examined the pharmacist's perspective of e-prescription implementation in Belgium's community pharmacy software and the frequency and severity of problems.	246 community pharmacists	• Incorrect use of code for medication identification • Unavailability of eHealth system • Need of manual additions • Slow response of software • Differences b/w the paper proof and e-prescription • Uncertainty about the error messages. • Interoperability issues	• Satisfaction with the e-prescribing system within their software • Knowledge of the *E*-Prescription workflow as they were trained to use the software during internships as part of their higher education	• Multivariable linear regression was used to analyse variables associated with pharmacist satisfaction with e-prescription implementation. Assumptions of linearity and homoscedasticity were verified, and a 2-sided p-value <0.05 was considered significant.

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Table 1 (*continued*)

First Author Time Country	Study Design(Data Collection method)	Research focus	Participants	Barriers	Facilitator	Analysis technique
Van Laere et al.[48] (2019a) Belgium	Cross-sectional Quantitative study (survey-based)	This study focused on pharmacists' perception of the implementation of the e-prescription within the software package and what other factors influence it.	246 community pharmacists	• Slow responsive system (negatively impacts satisfaction) • System failure or unavailability (negatively impacts satisfaction)	• Pharmacists had a moderate knowledge of the *E*-Prescription workflow as they were trained to use the software during internships as part of their higher education (positive effect on satisfaction)	• Results are presented as frequencies, percentages and means ± S.D. • Univariate relationships were analysed using independent *t*-tests and Chi-square tests. • Reported *P*-values are two-sided, with $P < 0.05$ considered significant.
Timonen et al.[47] (2018) Finland	Quantitative study (Data collected through a report form)	Aim of this study was to explore the experiences of pharmacists regarding the impact of e-prescriptions on the medicine dispensing process in Finnish community pharmacies	54 community pharmacies	• Incomplete prescriptions • Incorrect pharmaceutical form • Unclear medicine quantity • Inaccurate or ambiguous iteration details • The compound prescription is miswritten. • Medicine quantity was recorded in the incorrect field. • Iteration details are recorded in the incorrect field. • Wrong medicine • Generic substitution prohibition is missing altogether. • Inappropriate e-prescription quality • With e-prescriptions, tasks such as correcting dispensing entries afterwards (78%), correcting processing errors made during dispensing (77%), taking action to correct errors on the prescription caused by the physician (73%) and cancelling the dispensing of medication (64%) have become more difficult. • Increase pharmacist workload. • Delay in prescription delivery • Increased waiting time for patients • Negatively impact pharmacist's patient relationship • Work-related frustration	• Most pharmacists reported that processes such as prescription renewal (75%), transferring prescription data into the pharmacy data system (75%), receiving a prescription (74%), checking prescription information (62%), and making dispensing entries concerning the prescription (58%) have become easier with the implementation of e-prescriptions.	• Descriptive analysis with frequencies, percentages, and cross-tabulations was used. • X2 and Fisher's exact tests were employed to test differences between groups in the background characteristics, with P-values <0.05 considered statistically significant.
Kauppinen et al.[50] (2017) Finland	Cross-sectional Quantitative study (postal survey)	The study explored the impact of electronic prescriptions on the dispensing process in Finnish community pharmacies	778 participants, including 143 community pharmacists and 635 dispensers	• Ambiguities or errors that require clarification. • Software-related problems (slowed dispensing process) • making • Making corrections to the prescription has been hindered	• Improved medication safety • Easy prescription renewal • Easily transferring prescription data • Easy e-prescription receiving process. • Easy e-prescription processing • Reduced dispensing time. • Smooth workflow	• Descriptive analysis was performed using SPSS Statistics (Version 21.0), with frequencies, percentages, and cross-tabulation. Chi-squared and Fisher's exact tests were used to evaluate significant differences between groups, with a

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Table 1 (*continued*)

First Author Time Country	Study Design(Data Collection method)	Research focus	Participants	Barriers	Facilitator	Analysis technique
					• Less paper processing.	significance level of $P < 0.05$.
Campbell et al.[42] (2021) New Zealand	Qualitative Study Data were collected through face-to-face semi-structured interviews	Study findings focused on the e-prescription effect on pharmacists' professional workflow, interprofessional interactions and communication with prescribers and patients	4 GPs and 4 Community pharmacists	• Dealing with non-collection of dispensed items. • Limitations in software for clinical review, leading to potential gaps in patient care. • Lost opportunities to build rapport and gather patient information before dispensing, which were available when using paper prescriptions. • Patient expectations regarding prescription timing do not align with actual processing time. • Difficulties in reaching out to GPs for clarification on prescriptions when needed.	• Opportunity to get ahead on dispensing, making it easier to process multiple prescriptions efficiently. • Introduction of new channels for communication between pharmacists and other healthcare practitioners. • Use communication tools to convey dose change information or request help explaining complex dosing regimens. • Improving medication safety through Health mail and electronic prescription transfer. • Pharmacists and GPs are open to implementing new measures and technologies to improve medication safety.	• Thematic Analysis
Bilgener et al.[55] (2021) Turkey	Mixed method (Questionnaire)	To determine the opinion of pharmacists about e-prescribing	378 community pharmacists	• Physician-related problems (unrecognisable e-prescription code, incorrect code, lack of diagnosis, dose error, incorrect information entered by physician) • Selection of unpaid drug forms instead of paid, possibly due to unclear interfaces or inadequate training. • System related problem • Incompatibility between diagnosis and report codes for medical implementation notification • Patient-related problem (loss of e-prescription code by the patient) • Legal issues (holding the pharmacist responsible for errors)	• Improve drug delivery to the patient. • Decreased overall dispensing time. • patient safety • Improve legibility. • Minimisation of errors • Eliminate the problem of dispensing the wrong medication. • Reduction of workload.	• An independent-sample t-test was used to evaluate the difference in average satisfaction level with the e-prescription application between pharmacists who experienced problems and those who did not, with a significance level of P < 0.05.
Peikari et al.[51] (2015) Malaysia	Cross-sectional quantitative design (Survey)	The study investigated the extent to which second-generation e-prescribing usability leads to positive outcomes for community pharmacists	152 community pharmacists	• Not applicable	• Ease of use • Information quality • Consistency • Error prevention features of e-prescribing • Reduce workload. • Increase patient quality of care. • Improved outcomes for pharmacists were found to be associated with the improved ease of use ($P < 0.01$, $t = 5.79$) and information quality ($P < 0.01$, $t = 6.24$) of an e-prescribing system. • Furthermore, the ease of use of the system was found to be influenced by user interface consistency ($P < 0.01$, $t = 7.35$) and system error prevention ($P < 0.01$, $t = 5.29$)	• SPSS 16 was used for frequency and normal distribution analysis of respondents' demographics. • The research followed the guidelines of Haireta l 68 and employed the Partial Least Squares (PLS) technique. • Confirmatory factor analysis (CFA) was conducted using PLS to test the validity of the measurement model. • Reliability analysis utilised composite reliability (C.R.) and Cronbach's alpha techniques. • The hypotheses were examined using the PLS technique to assess their significance.

Table 2
Representing e-prescription exchange system.

Country	Centralised/ decentralised	Prescription database	Identifiers (physician/ patient/pharmacy)	e-prescription exchange system	Prescription Tracking (dispensing notification to prescriber)	Prescription Renewal (refill from prescriber to pharmacy)
Sweden	Centralised	National Pharmacy Database	Patient = Personal identity number (PIN) along with e-ID system Physician = Personal License number Pharmacy = Registered Pharmacy number	1. Patient information: name, social security number, drug name, and dosage entered by a certified physician. 2. Prescriptions are sent securely to the national pharmacy database. 3. Pharmacies access prescriptions through a human-computer interface with three layers. • Level 1: new e-prescription icon • Level 2: patient's social security number • Level 3: Pharmacists can review patients' other prescriptions. 4. The pharmacist manages IEPS prescriptions after reviewing the patient's other prescriptions.	Yes, e-prescriptions can be tracked through the system	The e-prescribing system directly facilitates prescription refills from prescriber to pharmacy.
England	Centralised	National Spine	Patient = NHS number Prescriber = General medical council number (GMC) Pharmacy = ODS (Organisational data service code) or GPhC (General Pharmaceutical Council number)/smartcard used for login.	1. EPSR1 prescriptions are standard paper prescriptions with an extra barcode. EPSR2 prescriptions are digital and signed electronically by the physician. 2. In EPSR1, when a community pharmacy scans the barcode, an electronic copy of the prescription data is downloaded to the system to populate the patient's medication record and the labels for the dispensed goods. 3. In EPSR2, the digitally signed prescription by the physician system is transmitted to the patient's preferred community pharmacy through a national central database called the Spine. 4. Patients are generally given a printed 'token' instead of a prescription, while the legal prescription is transferred to the pharmacy of their preference via the Spine. 5. Only certified physicians and pharmacy staff can access the system's prescriptions. 6. The system supports the electronic submission of reimbursement claims. The Spine is the central server that connects prescribing, dispensing, and reimbursement.	Yes, e-prescriptions can be tracked through the system	The e-prescribing system directly facilitates prescription refills from prescriber to pharmacy.
Belgium	Decentralised	Recip-e	Patient = National registration number (NRN) Physician = (unique identification number) Pharmacy = PIN (Pharmaceutical inspection number)	1. The doctor creates an e-prescription using the Recip-e service. 2. *E*-prescription is transmitted to a community pharmacy, and a paper copy is sent to the patient.	Yes, e-prescriptions can be tracked through the system	The e-prescribing system directly facilitates prescription refills from prescriber to pharmacy.
United States of America	Decentralised	Surescripts	Physician = National provider identifier(NPI) Pharmacy = Providers ID NCPDP(National Council for Prescription Drug Programs)	1. The doctor chooses to submit a prescription electronically through their e-prescribing vendor. 2. The e-prescription is sent to the electronic prescription routing	Yes, e-prescriptions can be tracked through the system	The e-prescribing system directly facilitates prescription refills from prescriber to pharmacy.

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Table 2 (*continued*)

Country	Centralised/ decentralised	Prescription database	Identifiers (physician/ patient/pharmacy)	e-prescription exchange system	Prescription Tracking (dispensing notification to prescriber)	Prescription Renewal (refill from prescriber to pharmacy)
				intermediary's network for routing to the designated pharmacy. 3. The e-prescription arrives at the pharmacy system's display screen and is opened in the work queue for processing. 4. If the pharmacy does not accept e-prescriptions, the intermediary converts the prescription to fax. 5. In the case of a renewal at the patient's request, the pharmacy sends a 'refill' request to the doctor once the refills have expired. The request is in the pharmacy and practice system message queues. 6. The physician can approve the request as sent, make restricted alterations, or deny it. 7. The pharmacist receives authorisation for a new prescription with a unique identifier. This relationship auto-populates the pharmacy system with prescription data.		
Canada	Centralised	Drug Information System	Physician = Prescriber identification number (PIN) Pharmacy = NAPRA (National Association of Pharmacy Regulatory Authorities number)	1. The prescriber communicates with the e-prescription warehouse through the Electronic Medical Record (EMR) prescription module. 2. The prescriber enters the patient's health insurance number. 3. The pharmacist or pharmacy technician at the patient's preferred pharmacy "pulls" data from the e-prescription warehouse into pharmacy management software. 4. The pharmacy's medication management software records all delivered medications and uploads them to a central database of prescription histories. 5. Doctors can access patients' drug records for prescription renewals and other clinical objectives.	Yes, e-prescriptions can be tracked through the system	The e-prescribing system directly facilitates prescription refills from prescriber to pharmacy.
Turkey	Centralised	Electronic Prescription System	Patient = Patient's Turkish identification number Physician = Physician Turkish identification number Pharmacy = Pharmacy registry number	Prescription exchange via MEDULA system (primary care physician generates prescription code, SSI sends and controls prescription code, pharmacist uses prescription code to dispense).	Yes, e-prescriptions can be tracked through the system	The e-prescribing system directly facilitates prescription refills from prescriber to pharmacy.
New Zealand	Centralised	New Zealand e-script service (NZePS)	Patient identifier = National Health Index (NHI) number Physician identifier = Practitioner Index Number Pharmacy identifier: Pharmacy License Number	1. The certified prescriber generates the prescription, noting the prescribing reason and any additional remarks. 2. The prescription is sent to the NZePS health information exchange facilitator securely. 3. The prescription is electronically downloaded at the community pharmacy. 4. The pharmacist can evaluate and process the prescription before sending the prescriber dispensing comments.	Yes, e-prescriptions can be tracked through the system	The system does not facilitate refills directly between the prescriber and pharmacy. However, prescribers and pharmacists have communication options to coordinate prescription renewals.

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Table 2 (*continued*)

Country	Centralised/ decentralised	Prescription database	Identifiers (physician/ patient/pharmacy)	e-prescription exchange system	Prescription Tracking (dispensing notification to prescriber)	Prescription Renewal (refill from prescriber to pharmacy)
				5. The NZePS integrates with various practice management systems, including MedTech, MyPractice, Indici, Profile for Windows, Medimap, Elixir and Expect Maternity and the Waikato District's Clinical Workstation Outpatient Prescribing service.		
Malaysia	Centralised	MyRx System	Patient = MyKad number Physician = Malaysian Medical Council(License number) Pharmacy = PBM (Pharmacy Board Malaysia number)	The National Electronic Health Record (NEHR) system allows providers to generate and transmit e-prescriptions to pharmacies.	Not Clear -	The e-prescribing system directly facilitates prescription refills from prescriber to pharmacy.
Finland	Centralised	Prescription Centre	Patient = Personal identity code (PIC) Physician = Personal license number Pharmacy = Registered pharmacy number	1. *E*-prescriptions are created by healthcare providers and submitted to the Prescription Centre. Any pharmacy in Finland can fill e-prescriptions, and the data system of the pharmacy searches the Prescription Centre for electronic prescriptions. 2. The Prescription Centre includes both electronic prescriptions and pharmacy dispensing information. It is accessible only by pharmacists and dispensers with pharmacy qualifications. 3. Any pharmacy in Finland can fill e-prescriptions. The data system of the pharmacy searches the Prescription Centre for electronic prescriptions. 4. Patient consent is always required to access their information. 5. Pharmacists or dispensers must utilise their healthcare professional cards to access and search for e-prescriptions in the Prescription Centre. 6. A pharmacist completes an e-prescription, signs electronically, and maintains dispensing records in the Prescription Centre.	Yes, e-prescriptions can be tracked through the system	The e-prescribing system directly facilitates prescription refills from prescriber to pharmacy.

improve pharmacists' perceptions of e-prescribing.

4.1. Environmental context and resources

System-related issues were the most cited, being mentioned in 22 of our included studies.[28,29,31–37,39–41,44–49,52,54,55] They were mainly considered a barrier to e-prescribing technology because system-related problems appeared to reduce work efficacy.[28,29,32,33,35,40,44,45,48–50,52] Concerns about system reliability[35,45] and content appropriateness for user needs —such as a lack of visual aids or codes for ordered drugs— make e-prescribing time consuming and thus considered a barrier.[28] Interoperability issues further complicate the scene, sometimes causing prescription errors.[32] Specific issues like duplicate prescriptions and barriers associated with electronically prescribing controlled medications presented more challenges.[40,41,44,46] However, it should be noted that the e-prescribing of controlled substances is now allowed in the USA.[56]

Pharmacists appreciated the improved security, legibility, and patient privacy offered by e-prescribing,[31,32,41,43–45,54] perceiving these as facilitators for its implementation. The quality of the information provided by the system was perceived as a facilitating aspect, as it can reduce pharmacists' workload and enhance patient care.[45,51] Nevertheless, certain limitations did temper these benefits. Slow processing, system freezes, data entry errors, and other associated challenges often frustrate users. When e-prescribing systems align well with existing processes, they enhance workflow efficiency.[33,37,40,45,50,54] However, several studies reported workflow disruptions, such as system problems and e-prescription errors, as barriers.[33,45,47,53] Incorporating workflow analysis into system design and minimizing workflow interruptions could resolve these issues.

Where e-prescribing systems seamlessly integrate with existing processes, a substantial improvement in efficiency emerges. However,

Table 3
Representing barriers to e-prescribing with TDF domains.

TDF Domain	First author	Barriers to e-prescribing
Environmental Context and Resources	Gagnon et al.[28] Motulsky et al.[29,52] Clauson et al.[43] Odukoya et al.[32,33,35] Rupp. et al.[44] Grossman et al.[36] Lander et al.[53] Rahimi et al.[45] Hammar et al.[54] Franklin et al.[46] Harvey et al.[37–39] Sara et al.[40] Van Laere et al.[48,49] Kauppinen et al.[50] Campbell et al.[42] Bilgener et al.[55] Terri et al.[41]	1. Integration issues 2. Perceived cost 3. Lack of formal training 4. Organisational factors like communication breakdown, pharmacy staff training and insufficient staffing level 5. Transaction fees are associated with renewal authorisation requests (still faxing renewals) and each e-prescription. 6. Require more dispensing terminals to work efficiently. 7. Implementation issues /no demand on behalf of the prescriber (low adoption by prescribers) 8. System-related Issues (negatively impact workflow) • Lack of push or alert system • Lack of visual aid in the system • lack of interoperability • Lack of standardisation • Transmission issues (causing time delays and bundling)/ Data transmission issues. • Auto-population of prescription field • Lack of training /technical support by the software vendor • Long-term design-specific issues (community pharmacists were not involved in the initial development). • Problematic interface causing issues with endorsing prescriptions and claiming reimbursements. • Unsigned prescription (prescription got stuck at the intermediatory system responsible for transferring a prescription from G.P. to pharmacy) • Using one smartcard to log all dispensing activities (Users cannot share Smartcards or access sessions.) • Lack of visual representation of the original prescription in the validation step (risk of error) • The adoption of the e-prescribing feature (electronic transmission) was lagging. • A paper order is an only a legal order/document. • Central warehouse structure (manual caparison required) • Issues arise when importing prescriptions like the pharmacy system automatically adding instructions. • Using a paper script for processing e-prescriptions (stationary use increases) • Differences in pharmacy and prescriber systems sometimes result in wrong patient selection (interoperability issues). • The complexity of prescription routing • The Drawbacks of e-prescription design (mismatched text box sizes, mismatched drug names, mismatched patient/physician names, mismatched drug quantities, and inability to discontinue old prescription). • Pharmacists were not able to change drug formulation to make it cost-effective for the patients (physicians need to prescribe formulation rather than just drug) • Reconciling prescription data fields between practice and pharmacy system • Inappropriate quality of patient instruction (system-related issue); therefore, staff had to edit specific fields. • Unavailability of eHealth system or slow response of software (negatively impacts satisfaction) • Software issues that cause workflow disruption due to errors in e-prescription or additional tasks associated with e-prescribing. • Poor visibility of e-prescription information • Missing or duplicate prescription or duplication of patient's profile on new prescription arrival • Problematic interface causing issues with endorsing prescriptions and claiming reimbursements. • Using one smartcard (card to access the system) to log in to all dispensing activities. (Users cannot share Smartcards or not even share access sessions.) • Problem with patients without a social security number • Time pressure is created due to backlog or slow system response. • Overreliance or complacency on the technology to detect errors. • *E*-prescriptions are lost or sent to the wrong pharmacy. • No alert system within the system • E-prescription is not allowed for controlled substances (split prescription, i.e., prescribing controlled substances through the paper script and other medicines through e-prescription) • Human system interaction
Professional Role and Identity Social Influence	Motulsky et al.[31] Terri et al.[41]	1. Disrupt the jurisdiction of community pharmacists by changing the distribution of information among G.P. and pharmacists. 2. Physicians are reluctant to give access to pharmacists for therapeutic indication. [*E*-prescribing technology allows for information sharing and benefits for pharmacists, but tensions arise between physicians and pharmacists due to the inadequate sharing of therapeutic indications. Physicians express reservations about pharmacists' involvement in medical decisions and believe that pharmacists may not have adequate patient information and clinical training to utilise therapeutic indications effectively. These tensions relate to the domains of professional role and identity and social influence, as

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Table 3 (*continued*)

TDF Domain	First author	Barriers to e-prescribing
		differences in roles and perceptions of authority, as well as community attitudes and norms, contribute to the challenges faced in properly using e-prescribing features.]
Belief about Consequences	Rupp. et al.[44] Timonen et al.[47] Bilgener et al.[55] Terri et al.[41] Campbell et al.[42]	1. Prescribing errors or e-prescriptions containing wrong information (insufficient or incomplete) 2. Increase pharmacist workload. 3. Delay in prescription delivery 4. Increased waiting time for patients 5. Negatively impact pharmacist's patient relationship 6. Work-related frustration.
Belief About Capabilities	Clauson et al.[43]	1. Resistance in acceptance to new technology (Experienced pharmacists who have been practising longer may be more accustomed to traditional paper-based methods or feel comfortable with their existing workflows, leading to resistance or less interest in adopting new technologies like e-prescribing).
Interpersonal and Professional Relationship	Motulsky et al.[31] Odukoya et al.[34] Terri et al.[41] Campbell et al.[42]	1. Communication issues with patient and prescriber.
Memory Attention and Decision Process	Odukoya et al.[34] Bilgener et al.[55]	1. Increase cognitive burden(a high amount of memorisation is required to fill out e-prescription. 2. Patients sometimes lose their e-prescription code (in Turkey, physicians provide patients with written prescription codes) [The loss of the e-prescription code may be attributed to issues such as forgetting where it was stored or misplacing the physical document.]
Reinforcement	Lander et al.[53] Bilgener et al.[55]	1. No incentives for pharmacists 2. Legal issues (holding the pharmacist responsible for errors) [can act as a negative reinforcement and discourage the use of e-prescribing systems]
Knowledge	Lander et al.[53] Hammar et al.[54] Terri et al.[41]	1. Patients/prescribers are unaware of the benefits of the e-prescribing system. [Patients and prescribers being unaware of the benefits of e-prescribing can hinder its adoption and usage. Lack of knowledge leads to resistance to change, reliance on outdated practices, and misconceptions about complexity. Limited access to information contributes to the barrier. Educating stakeholders through awareness campaigns and providing clear information can help overcome this barrier.]

recent studies have evidenced persistent system-related issues.[42,49,50,52] This longevity of issues underscores the need for persistent attention and improvement in e-prescribing systems.

To ensure an effective e-prescribing system, community pharmacists require accessible support systems that address their professional needs. Pharmacists' input during development is crucial.[29] Vendors should

Table 4
Represents the e-prescribing facilitators with the TDF domain.

TDF Domain	Study (First Author)	Facilitators to *E*-Prescribing
Environmental Context and Resources	Motulsky et al.[30] Clauson et al.[43] Odukoya et al.[32,33,35] Rupp et al.[44] Grossman et al.[36] Rahimi et al.[45] Hammar et al.[54] Harvey et al.[37,38] Garfield et al.[40] Bilgener et al.[55] Peikari, et al.[51] Terri et al.[41] Campbell et al.[42]	1. Enhance prescription processing: E-prescribing facilitates improved information quality, legibility, consistent sequences, and ease of archiving. It reduces the time required to retrieve old prescriptions and ensures consistency in the format of e-prescriptions, resulting in improved efficiency, reduced interruptions, and clarity. It also enables efficient electronic renewals and provides computerised tools and related services like online medication review, making it helpful in processing bulk prescriptions and aiding repeat dispensing. 2. Reduce dispensing time and pharmacist workload: By utilising e-prescribing, the dispensing time is reduced, leading to a decrease in the pharmacist's workload. This improves work efficiency, streamlines the workflow, and alleviates pressure on pharmacists. 3. Increase prescription security) (system related) 4. Chain pharmacies (more likely to implement e-prescribing than independent pharmacies) [Due to standardisation across locations, training and support resources, familiarity with technology, and customer expectations for efficiency, chain pharmacies are more likely to have a positive experience with and employ e-prescribing systems. This adoption facilitates the streamlining of operations, the improvement of service delivery, and the enhancement of customer satisfaction.] 5. Better access to patient information 6. User-friendly (user-friendly system acts as an enabler to e-prescribing technology) 7. Cost-effective 8. Sufficient training and experience (act as a facilitator to e-prescribing technology adoption) 9. Environmental conditions like adequate and consistent workflow layout
Social Professional Role and Identity	Motulsky et al.[30]	1. Boost the professionalisation of pharmacists. 2. Enhance professional judgment skills. 3. Raise the relevance of pharmacists' intervention. 4. Give awareness to physicians about pharmacists' contribution.
Belief About Consequences	Motulsky et al.[30] Clauson et al.[43] Grossman et al.[36] Rahimi et al.[45] Hammar et al.[54] Garfield et al.[40] Kauppinen	1. Improving patient health outcomes by improving patient safety (improving legibility, reducing medication error, reducing data entry errors) 2. It improved patient quality of care 3. More convenient for patients 4. Improved medication safety 5. Reduced pressure from a more consistent workflow. 6. Reduced dispensing time due to easy prescription processing by (Enhanced information quality,

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Table 4 (*continued*)

TDF Domain	Study (First Author)	Facilitators to *E*-Prescribing
	et al.[50] Bilgener et al.[55] Peikari et al.[51] Terri et al.[41]	improved legibility, Consistent sequences, ease of archiving, Reduced time in retrieving old prescriptions, Consistency in e-prescription format, Clarity and enhanced efficiency, reduced interruptions, efficient process of electronic renewals, Useful for processing bulk prescriptions, Aid repeat dispensing) as a result pharmacist's workload reduces, work efficiency improve, their relation with patients improve, and overall work pressure reduce
Knowledge Skills	Odukoya et al.[35] Van Laere et al.[48,49]	1. Good clinical drug knowledge 2. Knowledge of the *E*-Prescription workflow
	Terri et al.[41]	[Having a comprehensive grasp of the E-Prescription workflow, combined with sound clinical knowledge, enables identifying and resolving system-related issues and prescription errors that may occur during the process. This understanding fosters effective communication, reduces the likelihood of prescription inaccuracies, and enhances user satisfaction with the system.]
Interpersonal and Professional Relationship	Clauson et al.[43] Odukoya et al.[35] Hammar et al.[54] Garfield et al.[40] Terri et al.[41]	1. Faster service provision to patients [*E*-prescribing enables healthcare providers to deliver services more quickly, fostering improved relationships between providers and patients.] 2. E-prescribing encourages effective communication between prescribers and pharmacists, enhancing their professional relationships and facilitating collaboration. It ensures clear and precise communication, enabling them to work together more effectively, solve problems collaboratively, and promote a strong professional bond.

prioritise user-friendliness, incorporate real users in the design, provide guides and technical support, and ensure seamless integration with other systems. Neglecting these factors may lead to unintentional usage and compromise system efficacy.[39] In essence, while e-prescriptions are primarily perceived as facilitating and time-saving, especially with adequate training and support,[30,32,35–37,40,45,50,51,54] the environmental context and available resources must be meticulously considered and refined to realize the full potential of this technology. These recommendations align with previous literature, which emphasized the importance of user-centric design in healthcare informatics solutions.[57,58]

4.2. Memory attention and decision support, interpersonal and professional relationships, and reinforcement

Within memory, attention, and decision support domains, e-prescribing may pose challenges that increase pharmacists' cognitive burden.[34] In traditional paper-based prescriptions, pharmacists can annotate or highlight crucial information on the prescription. However, with e-prescribing, this vital information may be scattered across multiple screens or menus, necessitating pharmacists to actively search for and cross-reference details, ultimately leading to an elevated cognitive load.[34] This emphasizes the need for system designs that centralize essential details, reducing the cognitive strain on pharmacists.

Interpersonal dynamics, particularly relationships with other healthcare professionals and patients, emerge as key facilitators in the e-prescribing landscape.[33,38,39,41,52] Enhanced patient-pharmacist interactions, characterized by reduced wait times, are notable benefits.[31] However, miscommunication or a lack of communication can lead to confusion and misunderstandings.[29,32,39,40] Addressing these concerns requires streamlined communication interfaces and protocols, supplemented by continual education for healthcare providers and patients.

The costs associated with e-prescribing also featured as significant considerations.[43,53] *E*-prescribing streamlines the prescription process, saving staff time, yet its implementation can present challenges. Physicians are eligible for bonuses for electronic prescriptions, while pharmacists have to bear transaction fees for the service.[53] Concerns about increased costs[29,37,40,52] served as significant barriers. Without appropriate incentives, pharmacists may not have the motivation to invest in the technology or fully utilise its features. The potential increase in dispensing costs and resource requirements can affect the reinforcement domain by reducing sustained use. The recommendation includes incentivizing pharmacists, minimizing implementation costs, and ensuring access to necessary tools for effective system utilization. Our review aligns with another study that explored barriers and facilitators to implementing complex innovations in primary care settings. This literature review underscored the significance of policies and incentives, robust infrastructure, resource availability, engaging key stakeholders, organisational readiness, individual knowledge and beliefs, and the integration of innovations within existing workflows and systems.[59]

4.3. Belief about consequences, social influence and social/professional role and identity

Pharmacists largely view e-prescribing positively, citing benefits such as increased efficiency, heightened patient safety, reduced paperwork, and professional growth.[29,30,32,33,36–38,40,43–45,48,54,55] However, it depended on the quality and completeness of the information provided by the system to community pharmacists, enabling them to make suitable decisions.[51]

However, e-prescribing errors can be a significant risk and negate the benefits. According to the literature, e-prescriptions have an inherent error rate,[44,47] which may increase due to inadequate physician training.[41] Standardisation in drug names and prescription instructions can help reduce incomplete prescriptions.[47] These errors negatively impact patient safety and affect pharmacy efficiency by disrupting the usability and workflow due to complicated procedures involved in correcting e-prescriptions or flipping between multiple screens (integration issues) and increasing pharmacists' workload. To address these issues, pharmacy staff should be adequately trained to recover from e-prescription errors more efficiently.[35]

Further complications arise from communication breakdowns between healthcare professionals and patients. Increased calls for prescription clarification disrupt workflow. Additionally, a general misconception among patients that e-prescriptions ensure immediate availability of medications increases pharmacists' pressures to try to manage these unrealistic expectations.[33,44]

E-prescribing technology presents an opportunity for pharmacist involvement in medication management, but it could lengthen the prescription filling time because pharmacists are required by law and professional ethics to double-check prescription facts before dispensing medication to a patient.[30] Some studies[31,41] also identified physicians' reluctance to disclose therapeutic indications that create tensions between physicians and pharmacists.[31] Interventions management and building collaborative relationships between healthcare providers, highlighting the benefits of pharmacist involvement in medication management, and addressing concerns or misconceptions regarding pharmacist competence or scope of practice to address barriers related to professional role and identity in e-prescribing. By promoting the value of the pharmacist's role in medication management and addressing any

concerns or misconceptions, healthcare providers can collaborate more effectively to ensure patients' safe and effective medication use.

The integration of e-prescribing systems enhances pharmacists' professional role and image by showcasing their ability to effectively utilise technology, exercise professional judgment, and engage in advanced medication management practices. This elevates their status as healthcare professionals and increases awareness among physicians about the valuable contributions pharmacists bring to the healthcare team, fostering collaboration and improving interprofessional relationships.[30]

4.4. Knowledge, skill and belief about capabilities

A thorough understanding of the e-prescription workflow, coupled with strong clinical expertise, facilitates the identification and resolution of system-related issues and prescription errors that may arise during the process.[35,41,48,49] This comprehensive understanding promotes effective communication, diminishes the probability of prescription inaccuracies, and augments user satisfaction with the system.[44,48] The low adoption rates among prescribers have resulted in significant implementation issues, hindering the broader acceptance of e-prescribing.[52] This lack of adoption may be attributed to stakeholders' unawareness of the potential benefits associated with e-prescribing.[53,54] As a result, pharmacists often encounter the challenge of simultaneously handling both traditional paper prescriptions and electronic prescriptions. This dual system can introduce inefficiencies and inconsistencies, particularly in regions where e-prescribing is not mandated. This further complicates the workflow, potentially diminishing the intended benefits of e-prescribing. The implementation issues should be addressed along with more training programs for prescribers.

User acceptance is crucial for the success of any technology, including e-prescribing. Factors such as attitude, perceived usefulness, ease of use, professional growth, patient safety, awareness, productivity, I.T. skills, training, patient attitude, and self-efficacy impact the outcomes. Attitudes have a significant impact on acceptance, and a favourable attitude towards e-prescribing is crucial for its success. On the other hand, people who perceive little value in e-prescribing are less likely to use the technology. Most of the studies in our review indicated that pharmacists were receptive to the e-prescription system,[29,44,45,48,49,55] nevertheless, this catalyses its meaningful and efficient utilization. However, resistance to technology was reported as a barrier to e-prescribing implementation[43]; for instance, experienced pharmacists who have been practising for a long time may be more accustomed to traditional paper-based methods or may feel comfortable with their existing workflows, leading to resistance or less interest in adopting new technologies like e-prescribing. Resistance to change, especially in long-practising professionals, is a well-documented challenge in healthcare technology adoption.[60] However, it's essential to note that even in these situations, the gradual transition process, practical training, and continuous support can help ease the utilization and familiarization of the new system.

5. Strength

This systematic review aims to provide a comprehensive and up-to-date analysis of the positive and negative aspects associated with electronic prescribing (e-prescribing) in the context of community pharmacy practice. By examining the relevant literature, this review establishes a solid framework for enhancing the effectiveness and efficiency of community pharmacy practice through the adoption of e-prescribing. Additionally, this study provides empirically substantiated suggestions for community pharmacists. These recommendations facilitate informed decision-making and promote the integration of electronic prescribing systems within their professional domain. The findings of this study possess the capacity to greatly enhance the efficacy and user satisfaction of e-prescribing systems, thus leading to an improvement in patient care and medication management.

6. Limitation

Findings from this review should be evaluated with caution due to some of the limitations of this study. The literature search utilised only three databases (PubMed, Embase, and CINAHL). Thus, it is possible that relevant studies published in journals that are not indexed in these databases are not included. However, this systematic review employed a meticulous and detailed approach to the literature search, thereby ensuring the inclusion of a wide range of relevant studies on community pharmacists' perspectives of e-prescribing. Using this specific method improves the dependability of our findings. The reported results only pertain to content that has been published.

The different time periods and geographic locations of the included studies could be considered a limitation of the review. The studies encompass an extensive range of e-prescribing implementation and utilization stages, spanning the years 2000 to 2022 and multiple jurisdictions. Some studies describe the early adoption and implementation of e-prescribing, while others describe the experiences after its mandated use. Since e-prescribing is not universally mandated, the outcomes may not encapsulate all scenarios. The broad temporal and geographical scope, although lending comprehensiveness, compromises the depth of analysis for specific contexts. Only English-language studies were included in the review. This suggests that the results may not accurately reflect pharmacists' experiences in countries where English is not the primary language. The review comprised studies from numerous nations, however, a significant number of studies were conducted in countries with high incomes.

7. Conclusion

In recent years, electronic prescription systems have shown substantial promise in enhancing the quality, safety, and efficacy of pharmaceutical prescribing and dispensing. To harness the full potential of these systems within community pharmacies, it is vital to implement the following recommendations:

Address Design and Technical Issues: This review highlighted factors, such as design and technical issues, interoperability, attitude towards e-prescribing, productivity, and resources that play a crucial role in the effective utilization of e-prescribing by community pharmacists. Policymakers should address these issues, and the design process should involve community pharmacists and other users for a user-centric approach.

Optimize Productivity: Strategies should be identified to boost community pharmacists' productivity with electronic prescription systems, including streamlining workflows, providing tools to increase efficiency and acknowledging that electronic prescription systems might necessitate changes to current workflows. Formulate strategies and provide support to ensure pharmacists adapt seamlessly and the systems meet users' needs.

Promote Positive Attitudes: Develop initiatives to raise a positive attitude towards e-prescribing among community pharmacists. Education and training programs can be beneficial in this regard.

Allocate Sufficient Resources: Ensure community pharmacies have access to the necessary hardware and software resources to utilise electronic prescription systems effectively.

Stakeholder Education and Support: Provide ongoing education and support to all stakeholders involved in using electronic prescription systems. This can include training, troubleshooting assistance, and regular updates on system improvements. Workspace evaluation, user requirements definition, and stakeholder education and support are essential preparations.

Strengthen Collaboration: Collaboration among all system stakeholders is required to strengthen and support the electronic prescription system.

Incorporating these recommendations into practice facilitates the seamless integration of electronic prescription systems into the daily routines of community pharmacists, maximizing the benefits they offer in improving pharmaceutical prescribing and dispensing. This multi-faceted approach ensures that the potential of electronic prescription systems is harnessed to its fullest, ultimately resulting in safer and more efficient healthcare practices.

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CRediT authorship contribution statement

Amina Hareem: Data curation, Investigation, Methodology, Project administration, Resources, Validation, Writing – original draft, Writing – review & editing. **Joshua Lee:** Data curation, Investigation, Methodology, Project administration, Resources, Validation, Writing – review & editing. **Ieva Stupans:** Conceptualization, Investigation, Methodology, Project administration, Supervision, Resources, Validation, Writing – review & editing. **Joon Soo Park:** Data curation, Investigation, Methodology, Project administration, Supervision, Resources, Validation, Writing – review & editing. **Kate Wang:** Conceptualization, Data curation, Investigation, Methodology, Project administration, Supervision, Resources, Validation, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

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