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Barriers and facilitators to recovering from e-prescribing errors in community pharmacies

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Abstract

Objective—To explore barriers and facilitators to recovery from e-prescribing errors in community pharmacies and to explore practical solutions for work system redesign to ensure successful recovery from errors.

Design—Cross-sectional qualitative design using direct observations, interviews, and focus groups.

Setting—Five community pharmacies in Wisconsin.

Participants—13 pharmacists and 14 pharmacy technicians.

Interventions—Observational field notes and transcribed interviews and focus groups were subjected to thematic analysis guided by the Systems Engineering Initiative for Patient Safety (SEIPS) work system and patient safety model.

Main Outcome Measures—Barriers and facilitators to recovering from e-prescription errors in community pharmacies.

Results—Organizational factors, such as communication, training, teamwork, and staffing levels, play an important role in recovering from e-prescription errors. Other factors that could positively or negatively affect recovery of e-prescription errors include level of experience, knowledge of the pharmacy personnel, availability or usability of tools and technology, interruptions and time pressure when performing tasks, and noise in the physical environment.

Conclusion—The SEIPS model sheds light on key factors that may influence recovery from e-prescribing errors in pharmacies, including the environment, teamwork, communication, technology, tasks, and other organizational variables. To be successful in recovering from

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eprescribing errors, pharmacies must provide the appropriate working conditions that support recovery from errors.

Background

Electronic prescribing, commonly referred to as “e-prescribing,” enables prescribers to send e-prescriptions directly to pharmacy computer systems.^{1,2} E-prescribing has been implemented in U.S. health care systems to increase prescribing efficiency and reduce medication errors.³ Yet studies on e-prescribing have shown that its use can create medication errors that can negatively affect patient safety.⁴⁻⁷

A recent study of e-prescription dispensing in community pharmacies reported significant problems, including medication errors, omission of vital prescription information, and conflicting information on the prescription.⁵ The most frequently reported e-prescribing errors in this study included wrong drug, dose, dosage form, directions, days’ supply, and patient.

More than 1.5 million e-prescriptions are routed to community pharmacies daily and the number of e-prescriptions sent to community pharmacies is increasing annually.⁸ Pharmacy personnel are increasingly faced with the difficulties of addressing e-prescription errors by seeking out the intended medication treatment regimen from the prescriber to ensure that accurate prescriptions are dispensed to patients.⁶

The purpose of this study is to shed light on factors that influence pharmacists’ ability to detect and correct e-prescription errors. Error recovery is a patient safety concept that has been used to describe how pharmacists prevent medication errors in clinical practice, and it takes into consideration the specific processes used to detect and correct errors.⁹ Little is known about work system factors that facilitate or hinder pharmacists’ error recovery with e-prescribing. Exploring what factors promote or limit e-prescription error recovery will inform the development of interventions, such as technological or educational tools, that aim to promote recovery so as to enhance patient safety.

Objectives

This study sought to explore barriers and facilitators to recovery from e-prescribing errors in community pharmacies and to explore practical solutions for work system redesign to ensure successful recovery from errors.

Methods

We applied the Systems Engineering Initiative for Patient Safety (SEIPS) model¹⁰ to identify barriers and facilitators to recovery from e-prescribing errors in community pharmacies. This human factors model consists of five components of the work system (people, organization, technology/tools, tasks, and environment) that interact to influence processes of care that can positively or negatively affect the quality and safety of patient care.¹⁰ The SEIPS model has been successfully applied to research focused on improving safety and quality of care in hospitals¹¹ and community pharmacies.¹² This model takes a

system orientation to look beyond the skills and knowledge of individuals as the sole determinant of medication safety, and it focuses on components of the work system as potential contributing factors of error recovery.

This research was part of a larger study that explored the process and strategies used in community pharmacies to recover from e-prescription errors.^{9,13} Study participants included 13 pharmacists and 14 technicians from five community pharmacies in Wisconsin. The study was approved by the University of Wisconsin Institutional Review Board (IRB).

Observations and interviews

Phase 1 data collection consisted of observing participants in their work environment for 45 hours (two 4.5-hour sessions in each pharmacy). Guided by constructs of the SEIPS model, two of the authors took real-time field notes while observing how e-prescribing errors were recovered by participants as well as the elements within their natural work environment that affected this process. An e-prescribing error was defined as “any omission, inaccuracy, or ambiguity in e-prescription information.”⁹

Individual follow-up and semistructured interviews were conducted with participants to investigate further specific aspects of the work system that influenced recovery of e-prescribing errors (see the online Appendix for interview questions, available on JAPhA.org in the Supplemental Content section). Reflective notes¹⁴ were documented and discussed by the two researchers.

Focus groups

Phase 2 of data collection involved two 90-minute focus groups enabling participants from different pharmacies to discuss work system factors that influence e-prescribing error recovery as a group. A total of 12 participants (8 pharmacists and 4 technicians) who took part in phase 1 participated in two separate focus groups—one for pharmacists and one for technicians. Probes and prompts were based on the five main components of the work system model: people, organization, technology/tools, tasks, and environment.¹⁰

During the focus group, participants were provided with descriptions and examples of work system components and were asked to describe how any of the components might contribute to the recovery of e-prescribing errors. Examples of work system factors presented to participants are in the online Appendix.

Data analysis

A deductive approach to thematic analysis¹⁵ was used to identify work system factors that affect recovery from e-prescription errors. Audio recordings from interviews and focus groups were transcribed verbatim. Data obtained from these transcripts and observation field notes were analyzed using NVivo 10 qualitative software (QSR International, Burlington, MA). The primary author independently reviewed all observation field notes and transcripts to identify initial themes. To ensure reliability of codes identified, a second researcher (JS) reviewed 50% of coded transcripts. Additional coding was done by the primary author and

the second researcher to group themes into statements that could be perceived as being either a barrier or facilitator to error recovery.

Facilitators were defined as making the process of recovery easier, while barriers were defined as making the process harder. The primary author and the second researcher then categorized each coded theme under one of the five SEIPS work system components (people, organization, technology/tools, tasks, and environment).

Results

Participating pharmacies processed 120 to 400 e-prescriptions daily and had used e-prescribing systems for 3 to 7 years. Three pharmacies (two chains and one independent) were located in an urban region, and two independent pharmacies were in a rural region of Wisconsin. Each pharmacy typically had one to three pharmacists and one or two technicians working each day. The age range of participants was 22 to 69 years old, and their pharmacy experience ranged from 3 to 44 years.

Overall, the SEIPS model¹⁰ was useful in capturing themes related to important factors within the work system associated with the recovery of e-prescribing errors in community pharmacies. This model helped to identify barriers due to people, use of the e-prescribing technology, organizational policies, physical environment, and external environment. Although themes have been grouped under specific components, there are overlaps and interactions between each component.

Component 1: Person

Level of experience and training—Participants had a range of 3 to 9 years working with e-prescribing and expressed that experience with processing e-prescriptions could be a facilitator or barrier to recovery from errors. Participants with more years or more frequent experience with e-prescription errors were better able to recover from e-prescribing errors. Technicians explained that their level of experience, formal training (for example, technician certification coursework), and on-the-job training were important to recovering from e-prescribing errors. Pharmacists noted that more-experienced technicians had greater confidence in recovering from e-prescribing errors because they were more familiar with recurring errors and communicating with prescriber offices in resolving them.

Pharmacist: “More exposure to e-prescriptions [would be helpful] because you may [only] be familiar with how the other types of prescriptions work. If you don't have a lot of experience with e-prescriptions, then it makes it more challenging, because there are a lot of, we say an “error,” and we all sort of nod our heads, like, yeah, I see that all the time. But, if you don't see these [e-prescriptions] all the time, then you're not going to know what to look out for.”

Participants' drug knowledge was an important factor. A technician's clinical drug knowledge regarding appropriate dosage regimens facilitated recovery from e-prescribing errors and saved time when having to clarify with prescribers, while a lack of knowledge about drug therapy was a barrier. Moreover, participants' lack of knowledge about prescribers' e-prescribing processes was a barrier to understanding e-prescribing errors.

Participants stated that it would be beneficial to shadow prescribers to better understand how e-prescriptions were generated and transmitted to pharmacies.

Component 2: Tasks

Interruptions—Interruptions by telephone calls, patients, and pharmacy staff were a barrier to recovering from e-prescribing errors. Participants perceived that they had little control over the frequency of interruptions, and this slowed down recovery. Interruptions delayed participants from contacting prescriber offices for clarification on e-prescribing errors. Interruptions also reduced participants' attention when reviewing e-prescriptions for errors and prevented them from holistically evaluating the e-prescription. Thus, interruptions during e-prescription processing sometimes made participants cut corners and not fully review for errors. Interruptions also led to double work, multitasking when handling e-prescriptions, and distractions for participants.

Pharmacist: "You may get interrupted in the middle of checking a prescription and [identifying] what would have been an obvious error... but when you look at the pieces, like, just the directions or just the drug or just the quantity, it doesn't click that it's a problem."

Time pressure—Participants perceived that substantial time pressures—with patients waiting in the pharmacy and having a backlog of prescriptions to process—were barriers to recovery from e-prescribing errors. For example, Mondays were high-time pressure days, with a higher number of e-prescriptions. Participants expressed that it was difficult to determine task priorities in extremely high time-pressure environments. High-pressure periods in the pharmacy made participants feel overwhelmed because of the number of competing tasks that needed to be completed within a short period of time.

Pharmacist: "You're going faster than when you're backlogged. You may breeze through or skim things more quickly versus taking the time to read every single detail. You're multitasking; you're trying to get a lot of things done in a short period of time; that could potentially make it more difficult to catch errors."

Component 3: Environment

Physical environment of the pharmacy—Participants stated that small or cramped pharmacy spaces, noisy environment, poor lighting, and extreme temperatures were barriers to recovering from e-prescribing errors. Noisy environments were distracting and affected both participants' concentration and conversations with prescriber offices when addressing e-prescription errors. Sources of noise included music from the radio, face-to-face and telephonic conversations with patients or other pharmacy staff, noise of robotic equipment, and outside noise from the street or activity in larger stores. Loud noise in a community pharmacy was described as unfavorable and unprofessional.

Environmental facilitators included adequate lighting, appropriate temperature, consistent workflow layout, and a quieter work environment.

Pharmacist: "Another barrier that I've noticed is the drive-through window. At my store, we have a window that actually opens to the outside world, so you freeze in

the winter, and you die of heat stroke in the summer. And, you have patients who are using the drive-through most of the time—because they're in a hurry—so they're impatient. You're freezing, or you're hot, and it just leads to a potential of things being missed.”

External environment—Insurance policies governing medication prescribing and dispensing practices were categorized as external environmental factors that were barriers to recovering from e-prescription errors in a timely manner for patients.

In particular, some errors could not be corrected easily because insurance policies required the pharmacist to contact the prescriber before doing so; this added an additional step to the error-recovery process. For example, insurance policies regarding specific drug quantities prevented pharmacy staff from correcting wrong drug quantity errors without receiving a new e-prescription from the prescriber. Consequently, pharmacy staff frequently had to redo e-prescriptions to address specific insurance policies.

Pharmacy staff perceived that prescribers were not aware of specific insurance policies regarding medications that were not covered; this led to the need to intervene on e-prescriptions.

Pharmacist: “We call for pretty much everything because now, [even] if we even change a tablet to a capsule, we bill it to insurance. [Then] the insurance sees that it's different than what was originally ordered, and it causes a problem. So, we basically have to fax or take care of any changes. It needs to be right because we don't have an awful lot of leeway.”

Component 4: Tools and technologies

Pharmacy computer system: Design characteristics—Participants identified characteristics of their computer dispensing system that facilitated or hindered recovery from e-prescribing errors. For example, the clinical decision support (CDS), also known as drug utilization review alerts and flagging inappropriate drug dosing, made it easier to detect e-prescribing errors. The CDS systems assisted participants in detecting deviations from what the prescriber intended.

However, participants reported many aspects of their dispensing systems that made it more challenging to address e-prescribing errors. These included poor visibility of e-prescription information on pharmacy computer screen and duplication of patient profiles when a new e-prescription is received. Overreliance or complacency on the technology to detect errors was also mentioned as a negative consequence of using technology.

Pharmacist: “On the e-prescription, you don't see the whole prescription at one time. You don't see the doctor, the patient, and the drug all at the same time.”

Pharmacist: “Our system is nice in having the split screen. The downside of that is if the text is too long, the system removes it from the screen, or the system cuts it off, and you hit another button to see the whole thing. Because a lot of people don't use the notes, we sort of don't look down there all the time.”

Component 5: Organizational factors

Teamwork in the pharmacy—The e-prescriptions were reviewed by two or three pharmacy staff before medications were dispensed to patients. E-prescribing errors detected by technicians were discussed with pharmacists. The pharmacist or technician then contacted the prescriber's office. Using a team approach to address e-prescription errors was particularly important when the pharmacy was busy.

Pharmacist: “If the technician catches something or they question something, they'll refer to the pharmacist to verify – [whether] what they think is an error is really an error. Or just to get clarification, like, ‘how do you interpret this?’ They'll consult with another pharmacist or even another technician, but usually the pharmacist. So there still -are potentially two people involved.”

Communication breakdowns within the team were identified as a barrier. These occurred when e-prescribing error information had to be communicated during pharmacy staff shift changed and resulted in missing or inaccurate information being communicated.

Communication protocols between pharmacy staff and prescribers—Adequate and accurate communication with prescriber offices facilitated recovery from e-prescribing errors, while insufficient communication and communication protocols hindered recovery due to breakdown in the content and flow of information between pharmacy and clinic staff. E-prescribing errors detected by technicians were communicated to pharmacists, who then clarified with prescribers. Technicians also contacted prescribers if they perceived that the error was an obvious omission or calculation error made by the prescriber.

Communication with prescribers involved speaking with other clinic staff (receptionists and nurses) before the pharmacist was able to speak to the prescriber; this resulted in delays in recovery. Also, information transfer through multiple parties led to inaccuracies in communication. Participants stated that the current lack of easy communication with prescribers was a barrier.

Pharmacist: “It would be really convenient if we could just send the prescription back to them and highlight or circle areas that are incorrect or just send them a quick question, [like,] ‘Is this what you really intended to do?’ Instead, we have to go through the phone dance, and that can take anywhere from 5 minutes to 5 days. A lot of times finding the providers can be difficult. Because we'll receive e-prescriptions that are populated with contact information, we'll call them at that number, and they'll say, ‘This person is working at [his or her] other clinic today.’ So you have to call a whole bunch of different clinics to find out which one [he or she is] actually working at.”

On the other hand, participants stated that some prescribers used the comments field on e-prescriptions to communicate additional patient or drug information to pharmacies and this facilitated recovery.

Pharmacist: “On occasion, the doctor will write more instructions in this little note field, which sometimes will clarify things. If there is something that doesn't seem to match up with what the patient had before, there will be a note field where

sometimes the nurse will put in or the doctor will put in ‘new dose’ or ‘this is a new strength’ which is really helpful.”

Pharmacy staff training—Formal training provided by the pharmacy organization regarding the use of e-prescribing and associated errors was identified as a facilitator to recovering from errors. However, participants stated that they had received most of their e-prescribing training informally. Participants expressed the need for pharmacy organizations to identify trends in common e-prescribing errors and use this information during training sessions to increase staff awareness. Formal training on how prescribers generated e-prescriptions that were received in pharmacies would also facilitate recovery from e-prescribing errors.

Technician: “There's nothing in writing in a manual, but when we train people, we're going to train them how to resolve [e-prescribing errors]. But there's no [formal training], you know; it's usually on-the-job training.”

Staffing levels in the pharmacy—Participants reported that staffing levels were important to their ability to efficiently recover from e-prescribing errors. Adequate staffing enabled participants to address errors promptly before patients arrived in pharmacies. Conversely, low staffing levels made correction of e-prescribing errors slower, resulting in more interruptions for pharmacy staff, backlog of e-prescriptions, lack of thoughtful on-the-job training, and participants taking shortcuts when checking e-prescriptions for errors.

Pharmacist: “It's been a source of frustration sometimes for me when ... I'm at that level where I think I can use the extra help. Unfortunately, somebody else doesn't see it that way... I don't make the rules, so I don't have the power to draw off what I think would be beneficial for a pharmacy to be able to help patients [who] come in at the same time but also not get so overwhelmed, the temptation is to start doing shortcuts on checking.”

Discussion

New health information technologies (health IT) can contribute to system complexity and create unanticipated problems or new opportunities for errors to occur.^{16–20} Research suggests that most new errors involve breakdown in interprofessional communication regarding medication management and fragmentation of information that prevents a comprehensive and coherent view of patients' medications.^{17,21}

With increasing use of e-prescribing, studies have shown that pharmacists are vital in preventing errors,^{5,6,9,13} and their ability to recover from e-prescribing errors is important. This study describes relevant work system factors that influence recovery from e-prescribing errors in community pharmacies. The five components of the SEIPS model allowed the researchers to explore a comprehensive list of factors that could potentially improve the use of e-prescribing in community pharmacy settings.

Study findings indicate that organizational factors—such as communication, training, teamwork, and staffing levels—play an important role in recovering from e-prescribing

errors. This is consistent with a previous study; it found that organizational conditions in community pharmacies were important to consider when implementing cognitive pharmaceutical services such as medication therapy management.¹² Organizational factors such as adequate communication, staffing, and training facilitate recovery from e-prescribing errors, while a lack of any of these factors hinder recovery.

It was apparent that person or people factors, such as level of experience, knowledge, and education, also affected recovery from e-prescribing errors in the study pharmacies. Pharmacy organizations may need to review how to best support pharmacists' and technicians' knowledge of the e-prescribing process. This involves the provision of continuing education and formal training on safe and effective ways to recover from e-prescribing errors. For example, providing this support may entail increasing pharmacy staff awareness and knowledge about common errors and providing them with more training on how to deal with these errors.

Education and training result in capable and competent end-users of health IT.²² In addition to training on use of health IT, pharmacy personnel must also engage in continuous learning about drugs and patient care to be able to detect errors.²³ Such people factors shed light on areas of improvement for pharmacists and technicians. Pharmacy organizations may examine how best to support their staff to receive continuous education on use of health IT systems.

The results of this study also indicate that task components of the SEIPS model, such as interruptions and time pressure, can negatively influence e-prescribing error recovery processes. Pharmacists and technicians both indicated that these factors are barriers to recovery from e-prescribing errors. Interruptions are common in the workplace and can contribute to medication errors.²⁴ Distractions in the work system resulting from interruptions are a potential threat to patient safety.²⁵ The proper management of interruptions in pharmacy practice is important for making work systems safer.

In particular, momentary interruptions can derail a worker's train of thought,²⁶ disrupting pharmacists or technicians who are working on e-prescriptions, thereby causing loss of concentration involved in the appropriate detection or correction of errors. Community pharmacies have a culture of interruption.²⁷ Telephone interruptions have been reported to be the most frequent source of interruptions in community pharmacies.²⁸ This study identified telephone calls as a source of interruptions as well as interruptions by patients and other pharmacy staff.

Time pressure and heavy workload also have been reported to affect community pharmacy work quality.²⁹ Similarly, study findings suggest that time pressure and heavy workload are potential barriers for pharmacists and technicians to recover from e-prescribing errors. Further research is needed to quantify the impact of work-system factors on e-prescribing error recovery in community pharmacies. Future studies should also examine how errors are generated or recovered on the prescribing end.

Limitations

Several limitations of this research should be mentioned.

This study included a small number of pharmacy personnel, and data collection was limited to use of e-prescribing with no data obtained on traditional paper-based systems. Study findings do not take into account prescriber perspectives of addressing e-prescribing errors but only perspectives of community pharmacy personnel.

A deductive approach was used for thematic analysis, which may have limited identification of themes that were not reflected by the SEIPS model. In summary, several strategies (investigator and methodological triangulation,^{30–32} reflective journaling and audit trails,¹⁴ peer debriefing,³³ and participant quotes³⁴) were used to ensure analytical rigor in this qualitative inquiry.

Conclusion

The SEIPS model sheds light on key factors that may influence the recovery of e-prescribing errors in pharmacies. These relate to characteristics of the work environment, teamwork, communication, availability and usability of tools/technology, tasks, and organizational variables. Numerous factors within a pharmacy work system appear important in recovery from e-prescribing errors in community pharmacies. To be successful in recovering from e-prescribing errors, pharmacies must provide the appropriate working conditions that support recovery from errors by paying attention to staffing needs, improving communication skills, and providing continuous formal training regarding recovery from e-prescribing errors.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Key Points

Background:

- Although e-prescribing is widely used and has significantly increased in various health care settings to improve medication safety and prescribing efficiency, recent studies report generation of new kinds of medication errors.
- Error recovery is an important patient safety concept that involves understanding the process by which health care professionals detect and correct errors.
- This study focuses on factors that influence pharmacists' and pharmacy technicians' ability to efficiently recover from e-prescribing errors.

Findings:

- The process of error recovery in community pharmacies can be hindered or facilitated by a variety of work system factors.
- Work system barriers and facilitators to e-prescribing error recovery can be identified using the Systems Engineering Initiative for Patient Safety (SEIPS) work system model.
- In this study, pharmacists and pharmacy technicians reported that appropriate working conditions - such as having a quiet working environment, adequate communication, and teamwork - are important in preventing e-prescribing errors.