Society of Medical Education & Research

2021, Volume 1, Page No: 69-75
ISSN: 3108-4850

Annals of Pharmacy Education, Safety, and Public Health Advocacy

Introducing an Electronic Medical Record–Driven Evaluation of Medication Orders Performed by Beginner Pharmacy Students

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Abstract

This study aimed to pilot a simulated electronic medical record (EMR) activity that integrates a medication verification task, with the purpose of examining how novice learners interact with the system and assessing their perceptions and self-reported confidence when verifying medication orders. A quasi-experimental design was implemented using the MyDispense simulated EMR platform. Students were presented with five medication orders and were required to choose either "verify" or "reject" for each order. The activity was piloted among 390 second-year pharmacy students from Australia and Malaysia. Data on verification decisions and frequently occurring errors were extracted directly from MyDispense. Learner perceptions and confidence levels were measured through surveys administered before and after the activity. An expert panel subsequently analyzed the findings and proposed recommendations for a scaffolded curriculum.

Across the cases, most students (80.5%–94.4%) correctly identified the appropriate verification decision. Recurrent errors were mainly related to incorrect entries on the issues-for-review form, particularly involving medication duration and clinical indication. When medication orders were designed to be clinically ambiguous yet safe, novice learners tended to reject them rather than verify. A total of 277 preactivity and 261 postactivity survey responses were collected. Perceived confidence increased significantly, with median scores rising from 3 to 4 on a 5-point Likert scale, reflecting improved confidence in EMR-based medication verification. Based on these findings, a scaffolded curriculum aligned with experiential placement milestones was recommended. Although students demonstrated an overall increase in perceived confidence regarding medication verification, the results suggest a need for educators to better prepare learners for clinical documentation and interprofessional communication by promoting the recording of interventions and active engagement with prescribing teams beyond the electronic verification workflow.

Keywords: Pharmacy education, Simulation, Medical records, Dispensing

Introduction

Over recent decades, the adoption of digital health technologies, particularly electronic medical records (EMRs), has accelerated globally. This transformation places responsibility on educators to ensure that future health professionals develop the digital competencies required for contemporary practice. Inadequate training in EMR use has been associated with suboptimal patient outcomes [1, 2], whereas simulation-based education has been shown to enhance both EMR proficiency and patient safety [3]. For pharmacists working in hospital and health system settings, the ability to effectively review and verify medication orders within an EMR—commonly referred to as medication verification—is critical for ensuring patient safety. This task involves a multifaceted clinical judgment process that requires careful assessment of patient-specific information within the EMR to determine whether a medication order is appropriate for administration.

Simulation represents a key educational strategy for preparing students to use EMRs. Its effectiveness in health professions education is well established and is

Access this article online https://smerpub.com/

Received: 29 November 2020; **Accepted:** 05 February 2021

How to cite this article: Conti GR, Bellini M, Lombardo P. Introducing an Electronic Medical Record–Driven Evaluation of Medication Orders Performed by Beginner Pharmacy Students. Ann Pharm Educ Saf Public Health Advocacy. 2021;1:69-75. https://doi.org/10.51847/V0a9dvru6O

grounded in constructivist learning theories, such as situated cognition, which emphasize learning within authentic, practice-like contexts [4]. Simulation platforms therefore serve as an important bridge between didactic instruction and real-world clinical environments [5]. Previous studies involving student pharmacists have examined the impact of simulated EMR activities on perceived confidence and readiness for professional practice [6–8]. While existing evidence supports the value of EMR simulation, there remains limited research exploring how students approach medication verification specifically and how such activities should be introduced and progressively structured to optimally prepare learners for practice. Accordingly, the aim of this study was to pilot an EMR simulation incorporating a medication verification component to evaluate novice learners' system interactions, perceptions, and confidence, and to use identified common errors to inform recommendations for a scaffolded EMR curriculum.

Materials and Methods

Study design, setting, and participants

A quasi-experimental approach was employed using a simulated electronic medical record (EMR) delivered through the MyDispense platform. The activity was implemented with second-year undergraduate pharmacy students enrolled at two parallel campuses in Australia (n = 265) and Malaysia (n = 125), both of which deliver an identical curriculum concurrently.

Context and EMR activity description

The medication verification exercise took place within a 2-hour, in-person workshop during which all students completed the activity individually. Before attending the workshop, students undertook 2 hours of preparatory learning that focused on principles of medication review. This preparation was followed by an additional 2-hour interactive session aimed at strengthening students' ability to recognize and clearly communicate medication-related problems in clinical scenarios not reliant on EMRs.

During the workshop, students first watched an instructional video that explained the medication verification process. They then assumed the role of a hospital pharmacist within the simulated EMR environment, managing a fictitious patient prescribed five medications. For each medication order, students were required to select one of two verification options:

- Reject – indicating that the medication was unsafe, inappropriate, or suboptimal. This option required students to classify the medication-related problem and provide a brief open-text justification outlining the issue identified and a proposed resolution.
- Verify – indicating that the medication order was considered safe and appropriate, reflecting the student's acceptance of the order.

Although these two response options do not fully represent the range of actions available in all real-world EMR systems, they were intentionally simplified to suit novice pharmacy learners. In the local clinical context, most hospitals utilize EMR verification workflows that are conceptually similar to these two actions. Selecting the "Reject" option triggered an additional documentation step, requiring completion of an "issues for review" form in which students specified the identified problem and recommended a course of action for the prescriber. This documentation process was emphasized as a mechanism for advising monitoring and follow-up with the prescribing team.

The activity was co-designed by five final-year pharmacy students who had completed all experiential placements, together with two hospital-based practitioner educators. The five medication orders were intentionally constructed to fall into one of three categories: (1) safe and optimal, (2) safe but suboptimal, or (3) unsafe. Two of the five cases were designed as "safe but suboptimal" and deliberately framed as clinically ambiguous to prompt higher-level decision-making; although these orders were safe to administer initially, they required follow-up review.

Outcomes

The primary outcome focused on how students engaged with the activity, as measured by their verification decisions and the frequency and nature of common errors. Secondary outcomes included students' perceptions of the activity and their self-reported confidence in medication verification.

Data collection and analysis

User interaction data were extracted directly from the MyDispense platform and included recorded actions and any open-text justifications entered by students. Perceptions and confidence were assessed using surveys administered before and after the activity, incorporating

Likert-scale items and open-ended questions related to the verification process. Pre- and postsurvey Likert-scale responses were compared using the Mann–Whitney U test, with statistical significance set at $p < .05$.

An expert panel—comprising two hospital pharmacists, one final-year pharmacy student involved in the activity's co-design, and a simulation lead from the pharmacy program—reviewed the findings and developed curriculum recommendations informed by the user data and feedback. Open-text responses from both perception surveys and user documentation were analyzed using content analysis [9]. All statistical analyses were conducted using GraphPad Prism (Dotmatics, version 10.2.3). Ethical approval was obtained from the institution's Human Research Ethics Committee (project number 42675).

Results and Discussion

User responses and common errors

Across the five medication orders, the majority of participants (80.5%–94.4%) selected the correct verification action and corresponding rationale. Detailed user response data for each order are summarized in **Table 1**. Frequently observed errors included incorrect selection of categories within the issues-for-review form, suggesting challenges in accurately identifying the type of medication-related problem. Another common mistake involved specifying an inappropriate treatment duration, despite the absence of an explicit stop date in the medication orders. In addition, some students incorrectly indicated that a medication lacked a clinical indication when, in fact, a valid indication was present.

For the two medication orders intentionally designed to be clinically ambiguous yet appropriate for verification, students showed a marked tendency to reject rather than verify the orders (Verify 30.3% vs Reject 69.7%; Verify 7.9% vs Reject 92.1%). Notably, none of the students who chose the "verify" option documented any planned follow-up or communication with the treating team.

Table 1. Medication user data across the five verification scenarios (N = 390)

Medication	Intended classification	Verified (%)	Rejected (%)	Frequently observed errors
Prednisolone tablets	**Safe but suboptimal**: This case was intentionally constructed as a *clinically ambiguous* scenario. The prescription was safe for immediate administration to allow initiation of therapy; however, learners were expected to recognize the need for follow-up, including recommending a stat dose to complete day 1 therapy and adjusting to a higher ongoing dose thereafter.	7.9	92.1	• Incorrectly reported as lacking a clinical indication• Incorrect treatment duration stated
Paracetamol (Acetaminophen) tablets	**Safe and optimal**: The medication order met clinical standards and was appropriate for direct verification without modification.	94.4	5.6	• Incorrectly identified as not clinically indicated• Incorrect dose specified• Incorrect dosing frequency stated• Incorrect formulation reported
Salbutamol (Albuterol) metered-dose inhaler	**Safe but suboptimal**: This *clinically gray* order was safe for initial use to commence therapy, but was deliberately written to require subsequent optimization of both dose and frequency through discussion with the treating team.	30.3	69.7	• Incorrectly identified as contraindicated due to allergy• Incorrect duration reported• Incorrect interaction with another medicine stated
Pantoprazole tablets	**Safe and optimal**: The prescription was clinically appropriate and suitable for verification as written.	96.3	3.7	• Incorrect duration specified• Incorrect dose stated• Incorrect frequency reported

Fluticasone/umeclidinium/vilanterol inhaler	**Unsafe**: The Trellegy Ellipta order exceeded the recommended maximum dose and therefore required rejection. Learners were instructed on the importance of promptly communicating such interventions to the prescribing team to prevent medication-related harm.	19.5	80.5	• Incorrectly stated as not clinically indicated• Incorrect duration reported• Incorrect formulation identified• Incorrect frequency stated

Survey data

The response rate for the preactivity survey was 77 percent (206 students) at the Australian campus and 56 percent (71 students) at the Malaysian campus. For the postactivity survey, response rates were 75% (199 students) in Australia and 49.6% (62 students) in Malaysia. Overall, the majority of participants (84%, n = 206) reported no prior exposure to electronic medical records (EMRs), while 11 percent (n = 28) indicated they had observed medication verification being performed within an EMR, and only 4 percent (n = 11) reported having personally used an EMR to verify medication orders.

Analysis of Likert-scale items comparing perceived confidence before and after the activity across both campuses demonstrated a statistically significant improvement in confidence following the intervention ($p < .0001$), as summarized in **Table 2**.

Table 2. Median scores from pre- and postactivity 5-point likert scale items assessing students' self-reported confidence in using the mydispense EMR

Item	Confidence statement	Presurvey Median (IQR), n = 277	Postsurvey Median (IQR), n = 261	Pre–post comparison (p value)
1	Confidence in the ability to verify medication orders using a simulated EMR within MyDispense	3 (IQR: 2)	4 (IQR: 0)	< .0001
2	Confidence in navigating a simulated EMR and retrieving clinical information to conduct a patient medication review	3 (IQR: 3)	4 (IQR: 4)	< .0001
3	Confidence in recognizing medication-related problems when working with paper-based clinical documentation	4 (IQR: 1)	4 (IQR: 1)	.0004
4	Confidence in identifying medication-related problems using the MyDispense EMR platform	3 (IQR: 2)	4 (IQR: 0)	< .0001
5	Familiarity with, and confidence in, using the MyDispense software	4 (IQR: 1)	4 (IQR: 1)	.0609

Abbreviation: EMR, electronic medical record.

Before participating in the EMR simulation, students' descriptions of medication verification were generally short and nonspecific. Specifically, 11.51% of responses referred to reviewing medication history, another 11.51% described selecting the correct medication, 16% mentioned evaluating current medications, and 16.19% emphasized patient safety considerations. In contrast, following completion of the simulation, student responses became more detailed and conceptually focused, with 52.1% indicating that medication verification involved determining the suitability and appropriateness of a medication for an individual patient. Qualitative student feedback further emphasized the desire for increased time and repeated exposure to the activity, clearer guidance on efficiently navigating patient information within the EMR, and stronger preparation in recognizing medication-related problems and making informed verification decisions.

Recommendations for scaffolding EMR simulation across the pharmacy curriculum

Subsequent to the activity, an expert panel evaluated student feedback in conjunction with the identified common errors and proposed recommendations for future curriculum integration **(Table 3)**. The panel observed that while novice learners were generally effective at identifying fundamental medication safety issues, they experienced difficulty managing more complex considerations related to appropriate medication administration. In addition, the panel noted that a simple

binary choice between "verify" and "reject" did not adequately reflect the nuanced clinical reasoning required in real-world practice. As a result, the panel advocated for a structured, three-stage scaffolded model—novice, consolidation, and challenge—integrated with experiential placements, allowing progressive increases in clinical complexity at each stage.

Table 3. Recommendations for scaffolding EMR simulation across a pharmacy curriculum

Curricular Stage	Recommended Activities
Introduce novice learners to EMR simulation (early 1st or 2nd year, pre-experiential placement)	• Provide multiple examples of medication verification during preparatory learning and workshops, developed in collaboration with prescribers to ensure authenticity. • Engage students in EMR simulation at least three times (e.g., within workshop activities) prior to experiential placements. • Focus on fundamental medication verification exercises, such as detecting dose or frequency errors. • Incorporate formative assessments with opportunities for feedback and workshop debriefing. • Use a simple binary decision model with two options: verify or reject.
Consolidate EMR skills (shortly after first or second experiential placement)	• Increase complexity of medication verification exercises, requiring students to review more aspects of the patient's medical history, including identifying unnecessary medications or incorrect indications. • Continue formative assessments with structured feedback and debrief sessions.
Challenge EMR verification (prior to graduation)	• Introduce higher levels of uncertainty in verification tasks by incorporating a third option for "not ready to verify," helping students learn when suboptimal yet safe orders may be acceptable. • Implement summative assessments, such as incorporating EMR verification exercises into an OSCE.
Curricular Stage	**Recommended Activities**
Introduce novice learners to EMR simulation (early 1st or 2nd year, pre-experiential placement)	• Provide multiple examples of medication verification during preparatory learning and workshops, developed in collaboration with prescribers to ensure authenticity. • Engage students in EMR simulation at least three times (e.g., within workshop activities) prior to experiential placements. • Focus on fundamental medication verification exercises, such as detecting dose or frequency errors. • Incorporate formative assessments with opportunities for feedback and workshop debriefing. • Use a simple binary decision model with two options: verify or reject.

Abbreviations: EMR, electronic medical record; OSCE, Objective Structured Clinical Examination

Although students' self-reported confidence in medication verification improved after the simulation, common errors persisted. The expert panel attributed these mistakes primarily to unfamiliarity with EMRs and incomplete navigation of patient records. One frequent error involved incorrectly stating that a medication was not clinically indicated, suggesting difficulties in locating relevant information within the EMR. Another common issue was specifying incorrect durations, likely because students expected prescriptions to include explicit durations, as is typical in community pharmacy, rather than understanding the concept of ongoing daily review for inpatient medications.

Notably, students predominantly selected the "reject" option for the two "Safe but Suboptimal" orders and rarely documented follow-up with the prescriber. Although the study did not explore the reasons for this behavior, it may indicate that students perceive verification as a final judgment rather than part of a collaborative care process. It could also reflect hesitation to raise interventions with prescribers outside the electronic system or discomfort engaging with clinical uncertainty [10]. The importance of addressing uncertainty in clinical education has been highlighted previously, with recommendations for incorporating strategies such as team debriefs, role-playing, simulation, and storytelling to build learners' confidence and coping

skills in unpredictable clinical situations [11, 12]. Because most students had minimal prior exposure to hospital placements or interprofessional activities, this simulation was delivered before such experiential experiences, which are known to enhance confidence in collaborative clinical communication [13, 14].

These results align with prior studies showing that simulation can improve students' confidence for practice [6–8, 15]. Simulated EMR exercises are particularly valuable for verification training, as they reduce risks associated with granting learners access to real patient data [3]. However, EMR simulations must go beyond simple replication of clinical systems; they should be adaptable to learners' skill levels and allow ease of use for instructors and case designers [16]. Cost can be a barrier, as EMR platforms with ideal educational features are often expensive [17], emphasizing the importance of purposeful integration. In this study, MyDispense was used, which is freely accessible to educational institutions and hosted online to ensure accessibility even in areas with limited internet connectivity.

This study had several limitations. Preactivity and postactivity survey responses were anonymous and could not be linked, so comparisons were made at the group level. Additionally, as a pilot, it was impractical to examine the underlying reasoning behind students' verification decisions across a large cohort. Future research could explore learners' decision-making processes longitudinally, including how engagement with simulated EMRs evolves before and after experiential placements and interprofessional activities, with data linked for each student to monitor individual changes.

While students' perceived confidence improved overall, the study highlights the need to scaffold pharmacy learners in categorizing medication orders as: (a) Safe and Optimal, (b) Safe but Suboptimal yet Acceptable, or (c) Unsafe and Unsuitable for Administration. The binary "verify-or-reject" approach is insufficient to convey the urgency or nuances of required interventions. This underscores the importance of teaching students to document interventions clearly, specifying the medication-related problem and recommending appropriate actions, as well as engaging in verbal discussions with prescribers outside the EMR. Future implementation steps include adopting select expert recommendations from **Table 3**—enhancing preparatory learning on EMR verification, scaffolding learners to categorize orders according to safety and appropriateness, and co-designing verification activities with prescribers to foster more authentic clinical reasoning.

Conclusion

The simulation increased students' confidence in medication verification, but the findings highlight the need for learners to progress from basic verification to a more comprehensive clinical review. This involves documenting interventions that provide prescribers with clear, evidence-based recommendations addressing identified medication-related problems. The results also emphasize the value of scaffolding EMR training across the pharmacy curriculum: novice learners initially focus on deciding whether to verify or reject an order, while advanced learners must evaluate medication safety and appropriateness and determine the appropriate follow-up actions.

Acknowledgments: None

Conflict of Interest: None

Financial Support: None

Ethics Statement: None

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