BRIEF

Design, Implementation, and Assessment of a Simulated Inpatient Order Verification Activity in a Skills Based-Laboratory Course

Amy L. Ives, PharmD, Shannon R. Tucker, MS, James A. Trovato, PharmD, MBA

University of Maryland, School of Pharmacy, Baltimore, Maryland

Corresponding Author: Amy L. Ives, Department of Pharmacy Practice and Science, University of Maryland, School of Pharmacy, 20 N. Pine Street, Room N419, Baltimore, MD 21201. Tel: 410-706-5830. E-mail: aives@rx.umaryland.edu

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Objective. The primary objectives for this study were to measure student confidence and assess performance when processing inpatient medication orders. The secondary objective was to determine student opinions regarding electronic health record (EHR) technology.

Methods. Through the EHR platform, students processed inpatient medication orders during two laboratory sessions and one assessment. Each student was assigned one unique patient per session with three inpatient orders to process. Medication errors were randomly imbedded in the medication orders. Students needed to determine if the order was acceptable or required flagging due to an identified error. Pre and post survey responses were paired and assessed students’ level of confidence and perceptions regarding the simulated EHR activities. Aggregate performance scores were compared between the paper and EHR versions of this activity.

Results. A total of 108 out of 158 students (68%) had pre and post survey data that could be paired. Less than one quarter (24%) of students had prior hospital experience. For the medication verification questions, confidence levels doubled and, in some cases, tripled after EHR implementation. Results for all medication order processing questions were statistically significant. There was a statistically significant improvement in performance between the paper and EHR version of this activity. A significantly lower number of students felt the EHR would prepare them for experiential rotations.

Conclusion. Exposure to EHR technology improved student confidence and performance scores related to processing inpatient medication orders. These findings support the continued use of an EHR platform in skills-based activities.

Keywords: electronic health record, medication errors, simulation, order verification, laboratory instruction

INTRODUCTION

In the era of meaningful use technology with 95% of critical access Medicare hospitals participating in 2016, exposure to electronic health record (EHR) technology is an essential component of graduating a practice ready pharmacy student.1-4 As part of the Health Information Technology for Economic and Clinical Health Act (HiTECH) of 2009, Medicare and state Medicaid programs offer financial incentives to hospitals and providers participating in meaningful use technology. The overarching goal of meaningful use is to improve clinical outcomes through the use of EHR technology. The widespread adoption of EHR technology in health care since 2011 mandates that pharmacy students receive this training.2,4 Unfortunately, many advanced pharmacy practice experiences (APPEs) limit student access to hospital-based EHR systems.5 Although students may be able to write an encounter note with a preceptor co-signature, the functionality of verifying a medication order is not permitted by unlicensed trainees. Because of this limitation, it is incumbent upon pharmacy schools to provide this education.

Studies describing the use of EHR technology in pharmacy curricula are limited and primarily focus on students collecting the necessary subjective and objective data to document a patient encounter in SOAP note format.6-13 In a survey of US schools and colleges of pharmacy, 37% of respondents were utilizing an EHR system with the majority using it for collecting patient information (86%) or writing SOAP notes (59%). However, this survey is limited by a low response rate covering only 32% of pharmacy schools.14 In 2019, the American Association of Colleges of Pharmacy (AACP) pharmacy informatics task force published their recommended health informatics competencies which endorses the use of EHR technology in pharmacy curricula.15 The EHR is a tool that could be used to facilitate achievement of the core entrustable professional activity (EPA) “Fulfill a medication order” for new pharmacy graduates.16 This technology may also be useful to meet the core domains for APPE readiness.4,17
Our primary goal in selecting an EHR platform was to teach students how to process inpatient medication orders in a systematic way simulating real-world technology. The primary objectives for this study were to measure student confidence and assess performance when processing inpatient medication orders. The secondary objective was to determine student opinions regarding EHR technology.

METHODS

The health-system based skills laboratory course PHAR 538 Abilities Lab 3 (ABL 3) implemented EHR simulation for the purpose of inpatient medication order verification in the fall 2014 semester. ABL 3 occurs in the first semester of the second year (P2). This course has 50 assigned medications that are linked to the concurrent therapeutics curriculum, and these medications serve as the basis for the simulated medication orders. ABL 3 focuses on health-system based skills which was a critical factor in choosing an EHR platform.

Prior to the implementation of EHR technology in 2014, University of Maryland School of Pharmacy students were given a set of six medication orders on a simulated medication order form and were instructed that the order set contained at least two prescribing errors. Specific error types were discussed with students during facilitated practice weeks, but there was no systematic process provided for error detection. There were two practice weeks prior to the midterm practical and students were permitted to use drug information resources including the midterm practical. This assessment was worth 60 points and each medication order was assigned 10 points. For each individual order, answers were graded as “all or none”. While this experience provided students with practice identifying prescribing errors with inpatient medication orders, students were not being prepared for the EHR technology that they would encounter during APPE rotations. After vetting several products, the platform EHR Go! (Archetype Innovations, Inc., formerly Neehr Perfect) was specifically chosen for three reasons: as a web-based academic version of a hospital-based EHR, this platform allowed individual access to simulated patient data; the academic platform eliminated concerns of students accessing or compromising protected patient data while still providing an authentic simulation; this system allowed for customization of orders to intentionally create medication errors.

Students were introduced to the EHR technology during an orientation session in the form of a scavenger hunt designed to familiarize students with various parts of a medical record. Additional supporting materials were developed with step-by-step instructions for processing medication orders by course managers who also serve as weekly instructors. A recorded session on best practices for inpatient medication order processing utilizing medication safety principles and The Joint Commission (TJC) Standards was posted for students to view prior to practice sessions.

There were two practice laboratory sessions where each student was individually assigned one unique patient with three inpatient orders to process in the patient’s profile. Similar to the paper version of this activity, medications for these orders came from the course medication list and were randomly assigned to students. For each order, the student was asked to determine if the order was acceptable as written and could be verified (“verify”) or if the order required an intervention and had to be “flagged” back to the provider. Potential reasons for flagging an order included no allergy assessment performed or documented allergy to prescribed medication, dose range or interval range orders, wrong route of administration, wrong dose, wrong formulation, missing or wrong indication, and clinically relevant duplicate therapy. These medication errors were randomly distributed between orders. Students were also instructed that an allergy assessment was required. If “no allergy assessment” was documented, they were required to ask a facilitator if the patient had any allergies. Medication orders with intentional errors triggered alerts from the built in clinical decision support system. Alerts varied in applicability from logical to meaningless and students were taught to analyze each individual alert for its own merit. Student interpretation of an alert was assessed upon interaction with a facilitator. An assessment of inpatient order processing skills followed the two practice sessions. Similar to the practice weeks, the midterm practical consisted of one assigned patient with three medication orders and up to three medication errors. Students had to decide to “verify” or “flag” each order. Students recorded their answers on the customized scantron form which contained their name, the name of the assigned patient, the medication orders, the option to “verify” or “flag” the order, and the reason for flagging the order. The assessment was worth 90 points total with 30 points assigned to each of the three orders. Students received full credit for correctly identifying that an individual order should be verified or flagging an order with the correct rationale. Partial credit was given for identifying that an order should be flagged but selecting the wrong reason for flagging the order. Error types and medications were similar between the paper version (2013) and the EHR version (2014) of this activity.

Pre and post EHR implementation surveys were administered during scheduled class time to P2 Doctor of Pharmacy students enrolled in ABL 3. Pre and post survey data were paired based upon responses known only to the student (birth month and last four digits of their mobile phone number). Survey items were grouped into sections including background information, confidence in order processing skills, and opinions regarding the use of EHR technology. Pre and post surveys...
RESULTS

The mean order verification scores were 69 (n=120) and 83 (n=158) for paper and EHR respectively. The difference between the means was statistically significant (p<.05). A total of 108 out of 158 students (68%) had pre and post survey data that could be paired. Less than one quarter (24%) of students had hospital experience prior to the EHR activity. More than half (56%) of students reported no previous exposure to EHR technology. For the medication order processing questions, confidence levels doubled and, in some cases, tripled after EHR course implementation (Table 1). Results for all medication order processing questions were statistically significant (p<.0001). Student perception of the importance of EHR technology in pharmacy education was high to start with and did not change significantly after taking this course. However, significantly less students (82% and 66% pre and post survey respectively, p=.0039) reported that the EHR activity would prepare them for IPPE and APPE rotations (Table 2). The post survey indicated that approximately 60% of students would like to see the use the EHR continue in future years and 40% of students would like to see the EHR used in other courses.

DISCUSSION

This study is unique in that we assessed the real world skill of inpatient medication order verification. EHR technology allowed us to simulate a practice environment by assigning individual patients to each student and manipulating medication orders to intentionally create errors. The results of this study demonstrated an improvement in performance score when comparing the EHR activity to the paper version. Many studies have examined the use of the EHR on student performance related to the skills of documenting a patient encounter, performing medication reconciliation, and writing SOAP notes. To date, only one study has assessed the skill of inpatient medication order verification. Metzger and colleagues described their simulation activity during an introductory pharmacy practice experience (IPPE). In this study, groups of 12-16 students were provided access to a single patient record to complete order verification and medication reconciliation within the training domain of a hospital EHR system. While this use of a hospital-based EHR training system provided an authentic environment for students, lack of individual access, large group sizes, and use of a single patient limited student exposure to verifying multiple order types.

The results of our study demonstrated that students felt more confident in their ability to process orders in each of the five areas queried: selecting the correct patient, identifying a clinically relevant drug interaction, identifying inappropriate duplicate therapy, detecting a drug allergy and resolving range orders. Additionally, our results show that students did not perceive a benefit of the EHR to help them prepare for experiential rotations. Studies have reported a range of 73% - 95% of students feeling more prepared for APPE with the use of an EHR. However, studies have yielded conflicting results when a more rigorous statistical analysis is performed. Traditionally, students obtain exposure to EHR technology during IPPE and APPE rotations. Because ABL 3 occurs prior to these experiences, P2 students may lack perspective on the pervasiveness of EHR technology in the experiential setting. Furthermore, P2 students may not associate order verification with the ability to detect a medication order error or appreciate this skill as one of the unique contributions that a pharmacist brings to the health care team.

Potential limitations of this study include a lack of pre-lab materials and standardized error types in the paper version of this activity. We did not track the number of views for the pre-lab materials to know how many students looked at these materials in preparation for the EHR activity. Although medications and error types were similar between years, they were not exactly the same given the dynamic nature of our skills-based courses. In contrast, students were permitted to use drug information resources on the paper version of this activity but not the EHR version. We would expect the use of resources...
to favor performance on the paper version, but our findings demonstrate the opposite. An analysis of performance by error type(s) was not conducted but could help to inform future directions of this activity.

Student evaluations reflected the desire for additional practice weeks and more exposure to different medication order types. Based upon this feedback, future directions for this activity include increasing the number of weekly practice sessions to allow practice with more patients, additional medication orders per patient, and distribution of all medication errors types amongst students prior to the midterm practical assessment. Exposure to all medication error types during practice weeks will insure students have encountered a similar order prior to the assessment. Additionally, providing the list and assessing knowledge of course required medications at the beginning of the semester will encourage students to become familiar with these medications throughout skills-based laboratory and therapeutics related activities.

CONCLUSION

In our health-system based skills laboratory course we successfully implemented an EHR simulation platform to teach students how to verify inpatient medication orders in a systematic way that mimicked real-world processes. This EHR platform provided a realistic look and feel and enhanced students’ order verification skills compared to our previous paper version. Exposure to EHR technology improved student confidence in their ability to process inpatient medication orders and performance scores. However, fewer students felt that EHR technology prepared them for IPPE and APPE rotations after performing this order verification activity. These findings support the continued use of an EHR platform in skills-based activities to prepare students for future practice.

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REFERENCES


