Use of Medication Error Simulations in Continuing Professional Education to Effect Change To Practice

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ABSTRACT

Introduction: A novel continuing professional education CPE training program and simulation were used to teach pharmacists and pharmacy technicians about continuous quality improvement and how to identify, report, and communicate information regarding medication related errors using root cause analysis.

Methods: Pharmacists and pharmacy technicians attending a statewide pharmacy association meeting voluntary attended a CPE training program and simulation. During the simulation, learners investigated and identified medication related errors in three different pharmacy settings. A collection of items found at each pharmacy and audio recordings were used by learners to identify the medication related error. After each simulation, facilitators led a debriefing to discuss the learners' experiences. Data was collected using online surveys. Descriptive statistics and chi-square tests were used to analyze the data.

Results: Fourteen months following the program, 15 of the 67 participants responded to an anonymous survey. Of the 15 responding participants, 73.3% (11/15) were confident or very confident they could establish or maintain a high-quality continuous quality improvement plan at their practice site. Sixty percent (9/15) felt the experience reinforced their current practices, 13.3% (2/15) had implemented changes to their practice, and 13.3% (2/15) felt they needed more information before considering changes to their practice. Reported barriers to establishing a continuous quality improvement program were time constraints, 40.0% (6/15), system constraints, 26.7% (4/15), or lack of staff 20.0% (3/15).

Conclusion: A CPE training program and simulation reinforced practice for pharmacy personnel, resulted in changes to practice, and positively increased participants' confidence in establishing a continuous quality improvement plan in the workplace.

Keywords: simulation, continuing professional education, medication errors, root cause analysis, continuous quality improvement

Description of the Problem

Studies have shown that traditional continuing professional education methods (CPE) have minimal impact on changing a health care professional's practice.[1-4] The use of simulations and learning activities that are authentic and interactive have been found to be more likely to effect change to practice.[1,2] Training using simulation has been shown to facilitate the learning of new skills, maintenance of skills, and improved independence with skills by learners.[5,6] Simulations can be used to support CPE by introducing learners to new information and skills and providing opportunities to rehearse infrequent or serious events and the practice of complex, high level skills.[7]

Continuous quality improvement is a systematic evaluation of workflow to reduce errors and improve performance. Continuous quality improvement programs can significantly reduce errors and improve patient safety.[8] This study was conducted in a rural state in which the Board of Pharmacy requires all pharmacies to be majority-owned by a pharmacist. Due to the independent nature of the state's pharmacies, many lack structured policies and procedures for continuous quality improvement and medication error identification, reporting, and communication. In response to a state pharmacy statue requiring that all pharmacy permittees establish a continuous quality improvement program, the authors developed an innovative CPE training program to educate pharmacists and pharmacy technicians about the new statute.

Statement of Innovation

This manuscript describes the facilitation and evaluation of a novel CPE training and simulation used to teach pharmacists and pharmacy technicians how to identify, report, and communicate information regarding medication errors using root cause analysis (RCA) and continuous quality improvement (CQI). Learner perceptions, knowledge retention, and changes to practice over a 14-month period were measured. The North Dakota State University Institutional Review Board approved this research.

Innovation

The CPE program was facilitated by three faculty of the North Dakota State University School of Pharmacy and took place at a statewide pharmacy association meeting.   Sixty-seven attendees of the meeting participated in the program, 48 licensed pharmacists and 19 registered pharmacy technicians. The program was divided into two parts. The first 45 minutes were used to present a didactic overview of medication errors, patient safety, and continuous quality improvement. Following

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the presentation, three practice-based simulations were facilitated by the presenters. The overall objectives of the continuing professional education presentation and simulation were for participants to be able to: identify types of medication errors in institutional and community pharmacy, use root cause analysis to identify contributing factors to medication errors, identify strategies to reduce the rate of medication errors, identify resources available to pharmacists and patients regarding the identification and prevention of medication errors, and understand the North Dakota pharmacy statute on continuous quality improvement.

Each practice-based simulation was 20 minutes in length and focused on a different pharmacy practice setting: institutional, community, and long-term care. During each simulation, learners were to investigate and identify a medication related error and complete a RCA using fishbone analysis. To set the scene for each simulation and as a source of information, learners listened to audio recordings of individuals who had been mock interviewed regarding the medication error. As determined by the practice setting, audio recordings were heard from a pharmacy manager, pharmacist, pharmacy technician, charge nurse, nurse, certified nurse assistant, safety officer, mother, roommate, advanced pharmacy practice experience student, or emergency medical technician. After listening to the audio recordings, each table of participants received a collection of items found at the location of the medication related error. Participants were instructed to investigate the items and collectively complete a root cause analysis with their findings. Using information obtained from the audio recordings and the RCA, tables worked to identify the medication related error. After each simulation, the facilitators led a debriefing to discuss the identification of the medication related error, reporting and communication of the error, and ideas for minimizing the risk of future errors.

Simulations
For the institutional pharmacy simulation, participants received the following items: chart notes from the patient's electronic health record, a copy of the patient's medication administration record, and medications found in the patient's medication drawer on the unit. Participants were to identify that the medication administered to the patient had been misbranded while being packaged in the pharmacy. The patient received one tablet orally of potassium chloride 20 mEq twice daily in place of amoxicillin/clavulanic acid 500 mg twice daily. The error caused a sentinel event, which the patient did not survive.

For the community pharmacy simulation, participants received the following items: chart notes from a patient's electronic health record, inpatient and outpatient medication orders, filling records from pharmacy dispensing software, and oral medications from the patient's home. Participants were to identify that an incorrect medication was initially phoned into

the pharmacy for dispensing. The medication should have been tretinoin, but was called in as isotretinoin. The error was identified at re-admission of the patient to the hospital and was based on a published case study.[9]

For the long-term care pharmacy simulation, participants received the following items: remnants of recently administered medications, labeled medication cards, topical and liquid medications, a medication administration record, a 30-day vital signs history, and a fall risk warning. Participants were to identify that the patient received hydromorphone 1 mg/mL instead of the prescribed morphine 10 mg/5 mL, which resulted in an overdose of medication. The error caused a sentinel event in which the patient was transferred to an intensive care unit. Using RCA, participants were to recognize that the emergency kit had been stocked inappropriately at the nurse's station with the wrong medication and strength. The error was the result of a look-alike medication packaging error.

Each simulation was developed by a faculty member with work experience in the specific practice setting of the simulation. Each simulation took approximately 15 hours to develop. The total cost for simulation materials was $250 used for the purchase of stock medications and medication administration materials. The North Dakota Board of Pharmacy supported the cost of simulation materials. All other materials for example, order sets, records of dispensing, and vital signs history were created by the faculty using word processing software, dispensing software, audio recordings, and an educational electronic health record.

Three weeks following the CPE simulation, perception data was collected electronically through an independent CPE provider and de-identified prior to being reported to the researchers. The survey used a 5-point Likert scale (1 = *disagree* to 5 = *strongly agree*). In order for participants to receive CPE credit for attending the program, the survey was required of all participants (n=67).

Fourteen months after the CPE training program and simulation, all participants were invited to voluntarily complete an anonymous follow-up survey to assess knowledge retention and practice-based impact. The survey was developed by the facilitators and administered using Qualtrics® (Qualtrics, Provo, UT). Data was gathered using Dillman's Tailored Design Method.[10] Over the course of three weeks, participants were emailed weekly with a link to the survey. Consent was required for participants to advance to the survey. In order to control for previous experiences, baseline assessment prior to the educational intervention was considered. However, since the simulations were completed in groups, it was not possible to gather individual learner results from the simulation itself. While actual performance during the simulation could be one measure of learning, the authors determined that a better measure of learning was to measure overall individual

knowledge, confidence and practice change at a period of time at least 12 months after the CPE activity. The authors encourage others who aim to evaluate the impact of CPE activities to explore ways to measure baseline knowledge and behaviors on an individual level and to evaluate the long-term effects of their intervention in practice as compared to a self-reported survey. Additionally, measuring actual outcomes would better illustrate practice-based behavior change.[1,2]

The follow-up survey was comprised of 19 assessment questions used to determine knowledge retention of topics discussed during the CPE simulation 14 months prior. In addition, 3 demographic questions and 2 behavioral questions were used to capture other information about the participants. Fifteen participants responded. Of the 15 respondents, 11 (73.3%) were pharmacists. Of the 19 questions, 13 were answered correctly by 80% or greater of the participants. Participants demonstrated less retention (less than 60% of respondents answering correctly) in knowledge of the role of the United States Food and Drug Administration in medication errors, knowledge of the Board of Pharmacy Quality Improvement statutes, and knowledge of patient safety organizations and tools.

Participants were also asked to comment on the impact of the CPE simulation on their respective practices and practice sites. Nine out of 15 (60.0%) of participants felt the programming reinforced their current practices and two (13.3%) implemented changes in their practices. Of the 15 responding participants, 11 were confident or very confident (73.3%) that they could establish or maintain a high-quality continuous quality improvement plan at their practice site. Barriers to implementation of a continuous quality improvement program were time constraints (40.0%), system constraints (26.7%), or lack of staff (20.0%).

Critical Analysis
Traditional live CPE activities are often didactic and formatted as a passive learning experience for the learner. These activities have been shown to increase knowledge for learners, but rarely lead to practice-based change.[1-2] To encourage and support practice-based change for health care professionals, CPE activities should be interactive and pertinent to practice.[3] The educational outcomes and, therefore, impact on practice, are strengthened through application of educational content by the learner.[3] Practice-based simulations can be used to enhance continuing education programming. Use of simulations may increase knowledge retention of participants and ability to effect changes to practice.

This study found that after fourteen months, a CPE training program and simulation focused on pharmacy-based medication errors and patient safety was perceived by responding participants to be successful at reinforcing practice (60%), improving confidence to establishing or maintaining a

continuous quality improvement plan (73.3%), and effecting practice change (13.3%). Responding participants cited time constraints (40.0%), system constraints (26.7%), and lack of staff (20.0%) as barriers to practice change. Responding participants showed retention of knowledge on topics discussed during the CPE training program and simulation. However, these findings are limited by the low response rate (15/67).

Next Steps
Future CPE programming could focus on the role of the United States Food and Drug Administration in medication errors, Board of Pharmacy Quality Improvement statutes, and patient safety organizations and tools, as participants retained less knowledge on these topics.

Future research should focus on the use of medication error related simulations in CPE to decrease medication errors and near misses in practice by evaluating pharmacy-level outcomes. Additional inquiry into the impact of simulation in continuing education will benefit from a larger sample size. Additionally, evaluating the results on patient care of these practice-based behavior change will be important for the profession.

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