Improving Self-Perceived Competencies of Second Year Pharmacy Students through an Introductory Medication Reconciliation Rotation

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Abstract

**Objective:** Medication reconciliation (MedRec) is an essential healthcare function particularly relevant to pharmacists’ expertise and a learning opportunity for pharmacy students. Our objective was to assess change across clinical competence, confidence, and communication skills after completion of a medication reconciliation (MedRec) rotation by second year pharmacy students.

**Methods:** A retrospective post-then-pre survey including 29 questions was developed/delivered to students following the completion of required MedRec hours. The primary endpoint was the change in three domains via summed scores from individual questions. Cohen’s difference (d) was used to determine group-effect size change. Secondary endpoints included individual question change, perceived patient impact, and subgroup analyses.

**Results:** Of 115 P2 students, 81.7% (n=94) participated in the study. Students self-reported increases on the Likert Scale (0-10) of 2.49±1.90 in clinical competency domain (p<.001, d=1.52), 3.57±2.13 in confidence domain (p<.001, d=1.13), and 3.12±2.15 in communication skills domain (p<.001, d=1.57), representing large group-effect changes across all three. Twenty-one of the 22 individual questions had large group-effect changes; one question (nursing communications) had a moderate group-effect change. Student perception of MedRec impact on patient care (Likert Scale 0-10) was positive: post-rotation score 7.39±1.57.

**Conclusion:** To our knowledge, this is the first larger-scale study that examines student-evaluated outcomes of a MedRec-based rotation. Students self-reported high levels of post-rotation competency across all domains; students from ethnic minorities and with less work/MedRec experience increased their lower pre-rotation scores to statistically similar post-rotation scores, compared to non-minority and more experienced peers. Further study of the model and outcomes is advised.

**Keywords:**
Introduction

Medication reconciliation (MedRec) is an essential service recognized to improve patient safety, especially when combined with other error reduction programs (e.g., computerized physician order entry). MedRec is a requirement for organizational accreditation in the US.1-4 The World Health Organization has estimated that medication errors are responsible for more than one death per day and 1.3 million injuries per year in the US; the global costs of errors were nearly $42 billion US dollars.5

Pharmacists are “medication experts” within healthcare settings, and understanding the medications a patient takes upon entering a healthcare encounter is essential to providing quality care. Compared to other providers, when the pharmacy team performs a MedRec there are less admission-prescribing errors and adverse drug events (ADEs).6,7 Despite this, there is no recognized standard training covering MedRec for healthcare professionals, and training is not always provided. When provided, the quality and type of preparation varies by healthcare profession, institution, and workplace.8,9 Institutions may also lack adequate staffing and inter-profession communication to determine who is ideally situated to complete timely MedRecs.10

MedRec training programs described in literature are often small pilot programs examining patient safety/institutional outcomes rather than student learning outcomes (SLOs).11,12 Pharmacy students, after appropriate education, should be entrusted to complete MedRec activities under the supervision of a preceptor. As a foundational activity across patient care experiences, MedRec training should be carefully developed to ensure pharmacy students’ competence. Previous studies have shown that pharmacy students are effective in the MedRec workflow process; however, no large, published study describes specific skills students should learn in a MedRec-based or transitions of care experience.13,14 The Curriculum Outcomes and Entrustable Professional Activities (COEPA) 2022 guidance document provides a groundwork for these activities, specifically with The Pharmacists’ Patient Care Process in...
To create a better understanding of how pharmacy students can be effectively trained on MedRec as part of their PharmD education, we examined students’ perception of growth following the completion of a standardized pharmacy MedRec training experience.

2: Methods

2.1: Study Design

This was an IRB-approved observational, cohort study investigating self-perceived growth in SLOs of the MedRec experience for second-year PharmD (P2) students at The Ohio State University during the 2022-2023 academic year. Ohio State uses a traditional, 4-year model for PharmD education, and students complete Introductory Pharmacy Practice Experience (IPPEs) during their first three years. P1 is focused on community pharmacy, P2 on hospital pharmacy and this introductory MedRec rotation, and P3 students build upon their previous experiences with community, hospital, and elective patient care rotations. The MedRec rotation is a rigorous five-week IPPE at The Ohio State University Wexner Medical Center (Figure 1). Students are assigned to various services: critical care, acute cardiac care, and specialized cancer care to complete admission MedRecs on patients of differing complexity. SLOs for the P2 MedRec experience include enhancing communication skills, gaining experience with an electronic medical record (EMR), clinical problem solving, improving confidence with application of knowledge, and patient advocacy. For each case, students review the EMR, consult with pharmacies to get a fill history, interview the patient and/or caregiver, and document changes made to the admission medications/allergies in the EMR. Each student completes an average of 10 unique patient encounters over the 5-week rotation. Students work independently with input/support from a pharmacist preceptor as needed. Once completed, all changes are reviewed and the progress note is attested by the preceptor. Preceptors are College of Pharmacy faculty/instructors or hospital pharmacists with precepting experience.

After the rotation, we surveyed students using a retrospective post-then-pre design to gain insight into self-perceived change in skills. A modified Dillman’s method was used to optimize participation. The online survey instrument included a total of 26 questions; 22 questions focused on perceived
competency for core skills, each rated using a Likert scale of 0 (not competent) to 10 (fully competent) in post-then-pre fashion. Core skills questions were divided into three domains: clinical competency (n=10), confidence (n=5), and communication skills (n=7). Of the remaining four questions, one asked about perceived patient impact (post-rotation only) on a Likert scale of 0 (no positive impact) to 10 (extreme positive impact); three demographic questions asked about prior experiences in healthcare, pharmacy, and MedRec. Positive impact on patient care was defined using a modified Centers for Medicare and Medicaid Service patient quality measures statement. All students completed the survey as part of rotation requirements (for quality improvement) but participation in research was voluntary. Demographic data from the college registrar’s office including age, gender, ethnicity, and quartile of class by GPA were also recorded. Students who did not successfully complete their rotation within the study timeframe were excluded.

2.2: Endpoints

The primary endpoints were to determine change between the pre- and post-survey results in the summed score for the three domains. There were three secondary endpoints: 1) change between pre/post-survey results in the 22 individual skills questions; 2) student perception of impact of MedRec activities on patient care; and 3) sub-group analyses based on participant demographics.

2.3: Statistical Analyses

Data were first analyzed using descriptive statistics. Scores of individual questions (Likert scale), composite scores of subgroups of questions, and demographic factors were further compared using paired/unpaired Student’s t tests or one-way ANOVA, and χ² tests or Fisher’s exact tests, where appropriate. Associations between different composite scores or scores from single questions were assessed using Pearson’s correlation analyses. Cohen’s difference (Cohen’s d; d) was used to evaluate group effect size between two means as following: d≥.80, large effect; d=.50-.79, moderate effect; d<.50, small effect. A sample size of 74 was determined using Cohen’s method to find an expected moderate effect difference (Cohen’s d=0.5) for an individual question between pre- and post-surveys at the power
of 80% as previously described. All tests were two-sided, and the significance level was $\alpha=.05$. R4.1 software (https://www.r-project.org) was used.

3: Results

One-hundred-fifteen students completed the survey, with 81.7% (n=94) opting-in to research. Overall, 90.4% (n=85) reported that they currently worked in a pharmacy, with 50.6% (n=43) working 11+ hours per week. A majority, 76.6% (n=60), reported working in a hospital setting, with 27.7% (n=26) previously completing MedRec themselves and 11.7% (n=11) previously observing a pharmacist-performed MedRec. Survey respondents were 73.4% (n=69) female and 11.7% (n=11) Asian, 8.5% (n=8) Black, 61.7% (n=58) White, 3.2% (n=3) unreported, and 14.9% (n=14) other/multiple ethnicities.

Students’ self-reported increases on the Likert Scale (0-10) were 2.49±1.90 points in clinical competency domain (Likert pre=6.06±2.14 vs. post=8.55±.90, p<.001, d=1.52), 3.58±2.13 points in confidence domain (Likert pre=4.99±2.50 vs. post=8.57±.92, p<.001, d=1.13), and 3.12±2.15 points in communication domain (Likert pre=5.36±2.58 vs. post=8.48±1.18, p<.001, d=1.57) – see Figure 2. Individual question results available in supplemental materials. When asked about perception of MedRec impact on patient care, participants had a post-rotation rating of 7.39±1.57.

Sub-group analyses were completed to determine differences in the summed scores of the three domains by demographics. For each sub-group, differences between pre- to post-rotation summed scores by domain were also statistically significant (p<.05). However, the pre-rotation competency scores (on the Likert scale) as well as the post-rotation change in scores varied based upon the group to which the student belonged. Results by healthcare experience are described in Figures 3a through 3d, and results for GPA (by quartile) and racial/ethnic group are in Figures 3e and 3f.

4: Discussion

Our study showed that P2 students reported a large effect size change ($d\geq.80$) in clinical competence, confidence, and communication following a structured 5-week MedRec experience; this finding was consistent across relevant sub-groups. This confirms that the MedRec rotation as offered is likely beneficial to all, regardless of students’ previous work experience, MedRec exposure, or academic
standing. A 2020 systematic review of interprofessional activities performed by pharmacy students reported similar results across included studies, reporting improved self-perceived confidence, knowledge, and abilities.\textsuperscript{23} This is expected as experiential education frequently emphasizes higher-order learning activities such as application and analysis/evaluation.\textsuperscript{24}

Only one of the 22 individual survey questions demonstrated less than a large group effect (Communication Q6; moderate effect size). This examined student comfort with nursing staff and may reflect the variable need/opportunity for interaction in each MedRec. It is also possible that preceptors may not consistently emphasize the importance of nursing communications across cases.

Students generally appreciated significant change across all three domains after MedRec IPPE, but the magnitude of the absolute difference varied. Students with prior direct MedRec experience, those with more weekly pharmacy work hours, and those with previous/current hospital work experience reported higher pre-rotation scores than those with less experience. Regardless, experienced and inexperienced students alike achieved similar post-rotation scores. Except for previous MedRec experience, the final post-rotation scores for the three domains were not statistically different between experienced and less experienced groups (Figure 3a). This aligns with a previous study demonstrating that outcomes from clinical rotations are not statistically different between experienced/inexperienced students.\textsuperscript{25}

When grouped by academic achievement, the absolute change between pre- and post-rotation ratings was not statistically different between quartiles (Figure 3e). It appears all students perceived a similar level of improvement regardless of classroom achievements. In fact, students with higher academic GPAs (third and top-quartile) rated themselves more critically than the lowest two quartiles; in both pre- and post-rotation summaries, there was approximately one Likert point difference across the groups. Studies of undergraduate pharmacy students have similarly shown significant differences in self-assessment and objective performance measures. Lower-performing students’ self-perceptions differed more from external ratings – with these students rating themselves higher than the reviewer – than students of higher-performing backgrounds.\textsuperscript{26}
Study participants who identified as non-white were more likely to report lower pre-rotation scores, but not statistically different post-rotation scores (Figure 3f). Experiential learning is thought to enhance outcomes for a diverse background of students. Studies have described the biases and implicit challenges minority PharmD students face, yet it is reassuring to note similar experiential outcomes given guidance and proper programmatic development.\textsuperscript{27,28}

There are several strengths to this study, including the high participation rate, statistical power for primary endpoints, and the retrospective post-then-pre design used to reduce response shift bias. This methodology is appropriate to limiting inaccurate self-ratings at the pre-rotation time due to students being unfamiliar with MedRec itself or terminology used.\textsuperscript{18} Until this study, published literature about MedRec focused on the patient-based and/or health-system outcomes rather than SLOs within these MedRec programs, and were small pilot/trial programs or non-powered statistical studies.\textsuperscript{11,12,29} Single-program pilot studies of MedRec outcomes typically recruit students on a volunteer basis and consist of 3-19 students who completed a total of 32-215 medication histories (compared to this study where 94 students completed nearly one-thousand medication histories). In other studies, student pharmacists performing MedRec have helped to reduce hospital length of stay and readmissions, drug-related problems, and all-cause mortality rate.\textsuperscript{30,31}

There are also limitations to this study worth considering. This data reflects subjective perceptions from a single stakeholder – the student. However, this can supplement data from preceptor evaluations (routinely collected in IPPE/APPE rotations) and enhance understanding of the student experience. It may also improve students’ metacognitive practice, to compare their self-assessment against preceptor evaluations so they can self-identify gaps and better strive for the intended competency.\textsuperscript{32,33} Another limitation of the study is that generalizability of the data is unknown as it represents a single cohort of students from one institution. Data collection is underway for a subsequent cohort which will be used to confirm results. Finally, the survey tool itself is not validated as there was no published tool available to assess these outcomes (to our knowledge). However, our survey was developed specifically for this rotation experience by IPPE faculty/preceptors to assure content validity.
5: Conclusion

To our knowledge, this is the first published, powered-study which specifically examines student outcomes about a MedRec-based Doctor of Pharmacy rotation. Overall, results from this project indicate that students believe they are achieving stated learning outcomes for this P2 IPPE, and that benefits are robust regardless of prior MedRec/pharmacy experience or GP; this may be of particular importance for students of ethnically minoritized backgrounds and those with less professional experience at this point in curriculum. Further research into the best practices of evaluating outcomes for entrustable professional activities in pharmacy rotations is desirable, especially if student-described outcomes can be correlated with preceptor evaluations and support holistic assessment practices.

Keywords
Entrustable Professional Activity (EPA), Experiential Education, Introductory Pharmacy Practice Experience (IPPE), Medication Reconciliation, Student Pharmacist

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Figure 1: Ohio State College of Pharmacy P2 MedRec IPPE Rotation - Training Model and Expectations. Students complete five, 4-hour blocks for P2 MedRec IPPE, ideally occurring once weekly for five sequential weeks. Each block is supervised by a licensed pharmacist preceptor, and includes near-peer or peer-mentors for additional support, in a layered learning model. Experienced, high-performing IPPE and Advanced Pharmacy Practice Experience (APPE) students serve in support roles, as schedules allow. Mentor competency is determined by preceptors using objective/subjective measures (number of histories successfully, time-management skills in 4-hour shifts, student’s problem solving ability and willingness to persist through challenges; also student’s presentation and accuracy/documentation skills). Additional information about the IPPE/APPE schedules and general curricula available at https://pharmacy.osu.edu/education/doctor-pharmacy/i3-curriculum.

Figure 2: Primary Endpoints of Summed Outcome Domains, Pre- and Post-Rotation. The three summed scores for question domains of clinical competency, confidence, and communication presented in pre- and post-intervention format with standard deviation bars, for all 94 participants. Scarlet bars represent pre-results, and gray bars represent post-intervention results. All summed scores have a p-value difference of <.001. All questions and summed scores were reported to have a large effect size (Cohens d > 0.80).
Figure 3a: Previous MedRec Experience

Figure 3b: Other Healthcare Experience

Key
- Clinical Competency (pre)
- Clinical Competency (post)
- Confidence (pre)
- Confidence (post)
- Communication (pre)
- Communication (post)
Figure 3: Pre- and Post-Rotation Results of Outcome Domains, by Experience and Demographics. Domain summed scores, presented in pre- and post-intervention format with standard deviation bars, are presented here for four sub-groups. Figure 3a compares previous MedRec experience prior to this rotation. Figure 3b compares individuals who have previously or currently work non-pharmacy healthcare jobs versus those who have not. Figure 3c compares individuals who are previously or currently employed in a hospital pharmacy to those who have not worked in hospital pharmacy. Figure 3d compares hours worked in a pharmacy per week while in school for those who are employed in all settings. Figure 3e compares students via quartile of didactic GPA at end of P2 year. Figure 3f compares students who self-identify as white versus those who are non-white.

CRediT Author Statement

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Declaration of interests

☒ 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.

☐ The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

Highlights

- Research in student outcomes of medication reconciliation rotations is lacking
- Clinical competency, confidence, and communication can improve during rotations
- Minority students/less work experience students have lower pre-IPPE self-perception
- Minority/less experience students have statistically similar post-IPPE results
- Lower-quartile GPA students report higher pre-IPPE, similar post-IPPE competency