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Integration of Clinical Pharmacy into PA Education

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Abstract

Introduction
This study integrated a Clinical Pharmacist (CP) into Physician Assistant (PA) student clinical learning and evaluated the outcomes pertaining to pharmacological knowledge and clinical acumen. Literature supports the interprofessional collaboration of pharmacists and PA students within the didactic phase of learning, but this relationship has not yet been evaluated in clinical years.
Methods
Two cohorts of PA students from a single institution were asked to voluntarily participate in this study, n=58. Participation consisted of completing a survey before and after their clinical rotations. Students were randomly assigned to family medicine clinics, one of which included the CP. As part of this rotation, students were scheduled one half-day with the CP.
Results
Utilizing Repeated Measures MANCOVA analysis for all student participants before and after their clinical year, there was an increased understanding of chronic disease management, common medication dosing, common drug interactions, and the role of a CP ($Fs[1, 16] = 4.40$, $ps \leq .05$). Students who rotated with the CP reported even greater understanding of prior authorization submissions and when to refer or consult with a CP. These students also highly valued learning from a CP during their clinical rotations.
Discussion
This study suggests that incorporating CPs in the clinical curriculum is valued by PA students and associated with their self-reported greater understanding of pharmacological knowledge. This study further supports the efficacy of CP involvement in PA student education and is, to our knowledge, the first to examine CP integration in clinical learning.

Keywords: clinical pharmacy, PA clinical education, curriculum development, interprofessional education

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1. Introduction

An ongoing challenge of Physician Assistant (PA) education lies in teaching a comprehensive medical education in a relatively condensed program. With the ever-expanding breadth and depth of medical knowledge, attempts to expand the covered curriculum are in tension with the speed and time frame in which PA curricula is administered. Pharmacological study is a particular area where the expanding knowledge and evolution of evidence-guided practice are difficult to capture in PA education. Recent research within PA pharmacological education focuses heavily on how this education can be improved within the didactic phase of the curriculum.

Notable recent findings demonstrate increased effectiveness of didactic learning with dedicated pharmacy faculty, as well as with learning models that incorporate interprofessional case reviews with PA and pharmacy students (1,2,3,4) The positive interprofessional collaboration between pharmacy and PA students is evident when managing simulated patient cases. In managing these cases, the input and expertise of students from both professions is expanded on, and collaborative management is found to be associated with higher quality care and learning outcomes (5). Thus, the incorporation of pharmacists and pharmacy students in the didactic phase of PA education appears to be beneficial to the PA students' knowledge and understanding of pharmacological concepts. However, similar considerations have not been explored within the clinical phase of learning.

Pharmacists working within clinical settings are often referred to as Clinical Pharmacists. Clinical Pharmacy (CP) is a discipline in which pharmacists provide patient care that optimizes medication therapy and promotes health, wellness, and disease prevention (6). CP expertise offers a unique skill set of medication management within diabetic and other complicated patient populations, often complementing and expanding upon primary provider care. A comprehensive understanding of insurance coverages and the need for prior authorizations is an added layer of knowledge and quality of care providers and patients benefit from. The overall positive impact of CPs on ambulatory clinic staff and providers has been well documented and includes reduction of provider workload, work-related stress, and burnout (7,8,9) Much of the focus of this literature has been on provider wellness, leaving little known about how the addition of CPs in the ambulatory clinic affects PA student learning.

The present research examined whether PA students who shadowed a CP during their clinical rotation reported greater understanding of pharmacological knowledge, practical clinical knowledge (e.g., understanding of the prior authorization process, when to include CPs in a patient's care), and greater appreciation of collaborating and learning opportunities with a CP compared to students who did not rotate with a CP. The aim was to trial a sustainable method of continued pharmacology education into the clinical phase with the expectation that students would perceive an added benefit to their education similar to what previous studies have recognized of dedicated pharmacy educators within didactic phase learning.

2. Methods

Intervention

This pilot study was IRB exempt, Category 2, study number 301704-UT. Students placed within the university for their Family Medicine rotation were scheduled for one half day with the university primary care CP. This placement was random among students needing a local Family Medicine rotation. During this four-hour shadowing block, students were able to observe both in-person and telemedicine appointments with patients requiring medication titration, education, or follow-up with the CP. They were shown reports from Continuous Glucose Monitors and taught how to interpret and modify a patients' treatment based on their glucose values. Additional focus areas were supplemented based on what the student felt they needed to focus on, but many opted for a review of medications prescribed for diabetes and discussion about prior authorizations, insurance coverage, and drug cost. Evaluation At the end of the first clinical year in which clinical rotation with the CP was implemented, all students in the cohort were emailed an invitation to complete a brief anonymous online survey by PA faculty (Cohort 1).

The survey included questions about students' background including their age, gender, and the length of time they had worked in health care settings prior to their clinical rotations. To measure participants' age, students were asked to select among age categories to help ensure anonymity. Next, because students may have had various experiences working with a CP, the survey included questions about whether they had ever

worked with a CP, and if they had, what the context of that experience was (i.e., outside of their rotations, during rotations, or by shadowing a CP). Then students were asked to rate how much they understood several functions in which CPs routinely engage on a primary care team and questions about the value of learning from or working with a CP (see Table 2 for questions). Finally, students who had rotated with the CP were asked open-ended questions about their experiences working with the CP.

Reviewing data from Cohort 1, the evaluation questions were subsequently examined and refined. For Cohort 2, all students were emailed an invitation to complete the updated survey by the same faculty before their clinical year (pre-test) and again after the last rotation of their clinical year (post-test). In each of these pre- and post- experience surveys, students were asked to provide responses to three questions to create unique codes so that their responses could be matched across time points while still maintaining anonymity. Students then completed the same questions asked of Cohort 1 students and two additional quantitative questions (see Table 1 for questions and response formats and options). Other question improvements sought to distinguish various experiences students had had with CPs (e.g., lectures, rotating in other clinics).

Participants

59 students across two cohorts of the same program voluntarily participated in the survey and are tabulated in Table 1. Cohort 1 participants were 24 of the 39 students invited (62% response rate). Cohort 2 participants included 35 out of 37 students who responded to the pre-test survey (95% response rate) and 21 who responded to the post-test survey (57% response rate). Of the students participating in the post-test survey, 16 students' responses could be connected across time. Participants selected age categories suggested their ages ranged from 23 to –43 years of age with the majority of students falling in the 23 to 27 years age range.

Data Analyses

To examine whether students who rotated with the CP felt they had a better understanding of pharmacological knowledge and the role of a CP, independent samples t-tests were run to compare the means of the two groups. We next examined the extent to which 1) all students increased in their understanding of pharmacological knowledge and appreciation for the role of a CP over the course of their clinical year, and 2) whether this increase was greater for students who rotated with the CP compared to students who did not rotate with the CP. To address these questions, we ran repeated measures MANCOVA.

3. Results

Students who rotated with the CP reported higher understanding of the basics of insurance coverage and formularies, the role of a CP, and when to refer a patient to a CP. They also agreed more strongly in the benefit of collaborating with a CP for PAs and their patients, and the learning value of shadowing a CP (Table 1).

We found that from before to after their clinical year, students reported increased understanding of chronic disease management, the basics of diabetic management, common medication dosing, common drug interactions, and the role of, when to consult with, and when to refer to a CP ($Fs[1, 16] = 4.40$, $ps < .05$). Additionally, students who rotated with the CP, reported even greater increase in understanding of when to submit a prior authorization, when to refer a patient to a CP, and when to consult a CP. These students also had higher appreciation in the value of learning experiences with and shadowing a CP (see Table 2 for results of time by rotation group interactions).

The qualitative data was reviewed and subjectively grouped into themes shown in Table 3. Students who worked with a clinical pharmacist reflected favorably on their time with a CP either in didactic or clinical settings, with the 2022 cohort reporting the most significant impacts of the CP were increased pharmacotherapy knowledge (39%) and understanding of when to utilize a CP (39%). Similarly, the 2023 cohort overwhelmingly reported that CPs helped them to improve their pharmacotherapy knowledge (62%) but also that they believe CPs add value to patient care (31%). It should be noted that one student from the 2023 cohort did previously work with a pharmacist in a retail setting prior to matriculation into the PA program, with no students from the 2022 cohort having previous professional interaction with a pharmacist.

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Table 1- *Survey Questions and Response Formats*

Question	Response Format
What is your age (in years)?	Categorical: Age ranges (18 - 22, 23 - 27, etc.)
What is your current gender?	Text field
- I understand chronic disease management as it pertains to Family Medicine.	Likert: Strongly disagree to Strongly agree
- I understand the basics of diabetic management.	Likert: Strongly disagree to Strongly agree
- I understand continuous glucose monitoring.	Likert: Strongly disagree to Strongly agree
- I understand common medication dosing.	Likert: Strongly disagree to Strongly agree
- I understand common drug interactions.	Likert: Strongly disagree to Strongly agree
- I understand the basics of insurance coverage and formularies.	Likert: Strongly disagree to Strongly agree
- I understand when to submit prior authorizations.	Likert: Strongly disagree to Strongly agree
- I understand the role of a clinical pharmacist.	Likert: Strongly disagree to Strongly agree
- I understand when to refer a patient to a clinical pharmacist.	Likert-type response options: Strongly disagree → Strongly agree
- I understand when it would be beneficial to consult with a clinical pharmacist.	Likert: Strongly disagree to Strongly agree
- Physician assistants and/or their patients benefit from collaborating with a clinical pharmacist.	Likert: Strongly disagree to Strongly agree
- Shadowing a clinical pharmacist is a valuable learning opportunity.	Likert: Strongly disagree to Strongly agree
- Learning experiences with clinical pharmacists are important for physician assistant training.	Likert: Strongly disagree to Strongly agree
Prior to your clinical rotations, how long had you worked in a healthcare setting?	Categorical: Time ranges (A month or less, 2-6 months, etc.)
Learning experiences with clinical pharmacists (select all that apply):	Dichotomous (checked/not checked)
In what ways did your experiences shadowing Megan impact your learning?	Text field
What will you do differently in your future clinical work as a result?	Text field
In what ways did your other learning experiences impact your learning?	Text field
What will you do differently in your future clinical work as a result of these other experiences?	Text field
Additional thoughts or comments?	Text field

Table 2: *Gender, healthcare, and clinical pharmacist's experiences of Study Participants*

	Cohort 1 (post CP experience)	Cohort 2 (pre CP experience)	Cohort 2 (post CP experience)
Female	n (%) 17 (71%)	n (%)26 (74%)	n (%) 16 (76%)
Male	6 (25%)	9 (26%)	5 (24%)
Agender	1 (4%)	0	0
Previous healthcare experience	17 (68%)	27 (77%)	17 (81%)
Previous experience with a Clinical Pharmacist	7 (28%)	0	19 (90%)
No previous experience with a Clinical Pharmacist	18 (72%)	35 (100%)	2 (10%)

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Table 3. *Differences Between PA Students Who Rotated with a Clinical Pharmacist and Those Who Did Not (Control)*

	Cohort 1 Participants (2022)			**Cohort 2 Participants (2023)**		
	CP Rotation *n* = 6	Control *n* = 18	Group Diff.	CP Rotation *n*=10	Control *n*=11	Δ Across pre-post and Groups
	M (SD)	*M (SD)*	*t* (22)	*M (SD)*	*M (SD)*	*F* (1,16)
I understand…						
-chronic disease management as it pertains to Family Medicine.	5.33 (0.52)	5.11 (0.58)	0.83	5.00 (0.47)	5.27 (0.65)	0.52
-the basics of diabetic management.	5.00 (0.63)	5.06 (0.64)	-0.18	5.30 (0.68)	5.27 (0.48)	1.27
-continuous glucose monitoring.	5.00 (0.89)	4.61 (0.78)	1.02	5.20 (0.63)	4.91 (0.54)	0.02
-common medication dosing.	3.67 (1.37)	3.67 (1.19)	0.00	4.50 (0.71)	4.00 (1.10)	0.31
-common drug interactions.	4.67 (0.52)	4.44 (0.86)	0.60	4.50 (0.53)	4.36 (0.67)	0.00
-the basics of insurance coverage and formularies.	3.50 (1.38)	2.72 (1.18)	1.35+	3.80 (0.92)	3.45 (1.21)	2.96
-when to submit a prior authorization.	3.00 (1.27)	2.72 (1.41)	0.40	4.10 (0.99)	3.27 (1.27)	3.57+
-the role of a CP.	5.33 (0.82)	4.28 (0.96)	2.41**	5.40 (0.52)	5.09 (0.83)	1.81
-when to refer a patient to a CP.	5.33 (0.82)	3.50 (1.54)	2.76**	5.50 (0.53)	4.64 (0.67)	3.37+
-when it would be beneficial to consult a CP,	--	--	--	5.60 (0.52)	4.64 (0.51)	8.74**
PA and/or their patients benefit from collaborating with a CP.	6.00 (0.00)	5.50 (0.79)	2.70**	5.70 (0.48)	5.64 (0.51)	2.05
Shadowing a clinical pharmacist is a valuable learning opportunity.	5.83 (0.41)	4.56 (1.15)	4.02***	5.90 (0.32)	5.36 (0.51)	15.94***
Learning experiences with CP are important for PA training	--	--	--	5.70 (0.48)	5.27 (0.79)	4.59*

Note: Presented are post clinical-year evaluations for both groups. CP = Clinical Pharmacist; Control = students who did not rotate with the Clinical Pharmacist, t= independent samples t-test. Post = post-semester survey; Δ Across pre- post and Groups = results of MANCOVA analyses comparing whether change from pre- post- semester survey change occurred for students who rotated with CP compared to those who did not. + p < .10, * p < .05, ** p < .01, *** p < .001

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Table 4. *Qualitative Summary of Student Experience with a Clinical Pharmacist*

In what ways did these learning experiences with clinical pharmacists impact your learning?	**2022 post survey, n=18**	**2023 post survey, n=13**
Provided a different perspective to patient care	17%	15%
Increased pharmacotherapy knowledge (drug classes, indications, contraindications)	39%	62%
Increased understanding of when to utilize CP expertise	39%	15%
Increased insurance knowledge	17%	8%
Added value to patient care (patient education, more time spent with patient)	0%	31%
What are some things you believe you will do differently in your future clinical work as a result of these learning experiences with clinical pharmacists?	**2022 post survey, n=17**	**2023 post survey, n=9**
Higher standard and more well-rounded patient care	24%	33%
More likely to collaborate/consult CPs	71%	100%
Higher consideration for insurance coverage when prescribing	6%	0%

Note: These questions were asked to students after their clinical pharmacy experiences

4. Discussion

The purpose of this pilot study was to examine whether students who shadowed a CP during their clinical rotation reported greater understanding of pharmacological knowledge, practical clinical knowledge (e.g., understanding of the prior authorization process, when to include CPs in a patient's care), and appreciation for training with a CP compared to students who did not rotate with a CP.

To our knowledge, this is the first study to assess the impact of direct observance of a CP in practice on the education of PA students. While the sample size was small, we found evidence that incorporating CPs in the curriculum, particularly during the clinical year, is valued by PA students and associated with their reporting greater understanding of pharmacological knowledge and how to work with CPs. When comparing the results of the pre-clinical year survey with post-clinical year results for those who worked with a clinical pharmacist, many areas show promise. Overall, there is a positive trend in responses from students with CP interaction in most domains assessed by the study. For those who participated in a CP rotation, there is evidence of a greater positive change in questions regarding when to consult a CP, when to refer to a CP, when to submit a prior authorization, and assessment that time spent with a CP was valuable and that learning experiences with the CP are valuable for PA students.

The present research had weaknesses that limit the inferences that can be made about the findings. First, the sample included only two cohorts of PA students and rotations with one CP. Involvement of one CP did provide uniformity to the experience and allowed consistent expectations of learning, however, experiences with other CPs may be different. Second, this study relied on student's self-reported understanding rather than an objective measurement of knowledge. Future research may benefit from standardized performance measures to better understand the benefit of rotating with CPs.

Based on this pilot study, it seems that even a brief amount of time with CPs had positive outcomes on PA student learning. This benefit does not go without challenges as widespread implementation would require more CPs to contribute to PA education and adds a layer of complexity to scheduling during the clinical phase. Ideal implementation would likely include time with a CP within a practice that is already rotating PA students. Adding CPs in PA education could be further streamlined with specific lectures during the clinical year to all students in the cohort.

Future research may focus on increasing sample sizes or covering multiple iterations to establish a greater understanding and comparison of students across multiple PA programs, increasing contact time with a clinical pharmacist,

and increasing number of clinical pharmacists involved. Moreover, objective data from written exam scores or Objective Structured Clinical Examinations (OSCEs) may help to further quantify the impact.

5. Conclusion

Adding time with a CP during PA students' clinical rotation may be a tangible way to add pharmacological learning and practical clinical skills to PA curriculum. There is known value to collaboration between the professions demonstrated in the didactic phase of PA learning and this pilot study, while a small sample size, demonstrates a potential avenue for the interprofessional learning to continue during the clinical phase of PA curriculum. It's possible that even limited amounts of exposure time to CPs can give educational benefit to clinical students. Large scale studies as well as proposed models of implementation are necessary to encourage widespread incorporation of a CP into PA curricula.

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