Analysis of the Student Experience in an Attending Pharmacist Model General Medicine Advanced Pharmacy Practice Experience

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Objective. To characterize and determine the quality of the student experience in an attending pharmacist model (APM).

Methods. In-depth interviews were conducted with students completing an advanced pharmacy practice experience (APPE) at two general medicine services using the APM over a 2-year time period. Quantitative information about student learning and interprofessional interactions were extracted from student evaluations of the site. Data from the mixed model were analyzed to identify strengths of the APM and areas needing improvement.

Results. Strengths of the APM included positive student interaction with the pharmacy resident and more students reporting full integration in and accountability to the interprofessional team for patient outcomes compared to students in non-teaching models. A few students at one site reported a need for greater delineation of expectations, more initial support from preceptors, and initial responsibility for fewer patients. These factors were modified before the second APM year and subsequent reports from students at this site were uniformly positive. Students at the second site did not note areas needing improvement. The APM increased student capacity at both sites.

Conclusion. The attending pharmacist model provided a high quality learning experience for students, particularly with regard to integration into and accountability for patient outcomes to the interprofessional team. Qualitative research methods enabled precise detection of areas needing improvement at one site and confirmed that changes made at that site improved the student experience.

Keywords: experiential learning, quality assurance, qualitative research, preceptorship

INTRODUCTION

The concept of an “attending” physician as a practice model has been in place for centuries. Charles Smith, an apothecary who studied medicine at Trinity College, Ireland, wrote in 1746:1

“...it has been thought proper to endow an Infirmary for the reception of such sick and wounded poor, as shall offer themselves to the attending Physician or Surgeon to be cured.”

In this description, Smith implies that an attending physician is a health care provider at a specific care facility. The attending physician model was an integral part of the first medical residency program started in 1889 at Johns Hopkins School of Medicine, and became an educational and practice model. The medical residency model evolved into its current form over the first half of the 20th century.2 The advent in 1965 of Medicare payment for the attending physician who supervised medical residents meant that the attending physician role also became a model for reimbursement. The controversy over resident duty hours that began in 1971 resulted in liability implications for this model.2,3 Today, the attending physician is a highly experienced clinician who is usually a faculty member at a medical education institution. In the attending physician model, medical students and junior residents are primarily responsible for the daily care of patients, reporting to the senior resident who runs the service, while the attending physician serves as a mentor and consultant for team members.4

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Pharmacy residency programs began relatively recently with the first programs accredited by the American Society of Hospital Pharmacists in 1963. Pharmacy residencies have traditionally used the preceptor model, which arose from the apprenticeship system for training apothecaries. In the preceptor (from the Latin praecent: to instruct or to warn) model, an experienced pharmacist-preceptor works one-on-one with a pharmacy trainee, either a resident or student pharmacist. Regulatory bodies have historically allowed accrual of training hours toward pharmacist licensure for student pharmacists only under the supervision of a single identified pharmacist preceptor, and professional organizations have advocated a 1:1 or 1:2 preceptor-student ratio. Pharmacy traineeships have thus traditionally employed a different model from medicine traineeships for teaching and mentoring students and residents. However, there is concern over an inadequate supply of inpatient sites to meet student pharmacist placement needs, there is interest in adopting the attending model in inpatient settings to increase student training capacity.

Some benefits of the traditional preceptor model are also seen with the attending pharmacist model (APM). Resident and student pharmacists can improve a health care organization’s ability to provide pharmacist care to all patients. Students given primary responsibility for patients are more invested in producing optimal outcomes for their patients. Yet there may be additional benefits of an APM over the traditional model. Residents may be more likely to remember what confuses a student new to a practice setting and provide increased coaching and role modeling to the novice APPE student. Student pharmacists benefit from an attending pharmacist’s expert opinion when thinking through options in difficult situations, but may more quickly integrate into the interprofessional team when acting independently as the primary pharmacist for that team. Other potential benefits of a hierarchical model similar to the medical attending model include increasing the number of institutional experiences offered to student pharmacists, increasing the number of resident pharmacists, increasing the availability of pharmacy services in different medical services, and expanding pharmacy presence as a whole throughout the medical center.

There are inherent differences between pharmacy and medical education and practice, which mean an APM may never function exactly like an attending physician model. Medical students typically spend two or more years of practice-based learning rotating in inpatient and clinic sites in a single health care system. Pharmacy students typically spend one year of practice-based learning rotating through a variety of practice settings and health care systems. Pharmacy residencies are shorter in length than medical residencies, meaning there are fewer pharmacy residents available to guide pharmacy students as compared to medical resident guidance of medical students. Medical service teams provide care to all patients admitted to a specific service. Medical consulting teams provide recommendations only for referred patients from multiple services. Pharmacists do both. They are expected to provide care to all patients, yet function essentially as a consult service for multiple medical teams, which results in a large overall patient load. The short time periods that students spend at a wide variety of sites where they are exposed to a large number of patients is not a model that encourages accountability for patient outcomes.

Although the APM, also called the “layered learning model,” has been successfully implemented at the University of North Carolina, the University of Wisconsin Hospital and Clinics, and the University of Chicago Medical Center, descriptions and outcomes of these models have not been published in a peer-reviewed journal. The only peer-reviewed description of an APM comes from the Cleveland Clinic, which implemented an APM in their Weston, Florida institution in 2011. In this model, attending pharmacists are assigned five to six pharmacy students per assignment block. The report does not indicate the role of the pharmacy resident on the team, other than as a team member. The implication is that the students report directly to the attending pharmacist. The outcomes measured in this report were consumer satisfaction scores, average daily number of pharmacy interventions, and bedside medication delivery capture rate, all of which improved in the new model. The student experience was not explored.

The Accreditation Council for Pharmacy Education (ACPE) in Accreditation Standards 2007 required that all schools and colleges of pharmacy have in place a quality assurance program for experiential education sites and will continue in ACPE Standards 2016. Professional pharmacy organizations have echoed the need for quality indicators in experiential education, while advocating innovative training models. Quality assurance was the third most frequently mentioned concern expressed by experiential education directors in 2011, with site capacity being the top concern. Despite a clear mandate for quality assurance, little has been published on how to measure quality of student experiences in the practice setting, other than examination of information obtained from student site evaluations. Student site evaluations provide limited information about the quality of students’ experiences at their site, making it difficult for experiential education directors to identify what is done
METHODS

This study used mixed methods to identify student-perceived areas of excellence and needed changes in the APM. Qualitative data were collected via semi-structured interviews with students completing APMs during the 2013-2014 (Year 1) and 2014-2015 (Year 2) academic years at the two sites to gain insight into the students’ experiences and identify what elements the students felt most enhanced and detracted from their learning. Quantitative data from all students completing APM experiences at either of the two sites were collected and analyzed. The questions asked in the interview were intended to clarify the structure of the experience, acclimation to the site, interactions (including support), curricular preparation for and overall impression of the experience.

The first set of interviews was conducted in response to concerns about the APM experience at one of the two sites expressed by a student to the experiential education team in January of Year 1. The questions were developed and tested during an initial interview, with minor refinements to question wording made based on feedback from the interviewed student, then used for all subsequent interviews in Year 1 and Year 2. After reading about and discussing in-depth interviewing techniques, a fourth-year (P4) student while on an APPE with the primary author conducted interviews in February of Year 1 with students who had completed the APM at Sites A and B. The interviews were digitally recorded, transcribed and summarized by the interviewing student, who performed member checking by reading the written summary back to the interviewed student to verify accuracy. All transcriptions were de-identified.

Data from the first set of interviews in Year 1 were analyzed informally to determine areas needing improvement, and summary results were communicated to medical center APM supervisors. The supervisors designed and implemented model changes to address areas of deficiency prior to the start of Year 2. Three changes were made to the APM: increasing student support by preceptors when there is no resident on service during the first week of the APPE, giving the student responsibility for only a few patients in the first week and increasing up to the full service by the end of week 1 or 2, and providing clearly delineated expectations for student pharmacist, resident pharmacist, and attending pharmacist. Interviews with Year 2 students who had completed an APM before March of Year 2 were planned to determine whether changes made to the APM were successful. These interviews were conducted, recorded, transcribed, and de-identified by two experiential education staff members. Interviews in Year 2 continued until saturation was achieved at each of the sites.

Data from interviews in Year 1 and Year 2 were analyzed at the end of Year 2 to determine the structure of the APM at each site, characterize the students’ experiences within the model, and compare similarity of Year 1 and Year 2 student experiences at each of the sites. Thematic analysis was performed on transcribed interview responses to questions. A research assistant and one P4 student, guided by the primary author, first independently identified common themes in the student statements by manually highlighting words and phrases that shared similarities in contextual meaning across statements. These two primary coders met repeatedly to compare identified themes, reconcile differences, improve theme descriptions, identify key words, and develop coding descriptions.

All statements were coded; each response could be coded into multiple themes. To test robustness of theme descriptions, an independent coder acted as verifier by coding a subset of the responses using the descriptions created by the primary coders. Cohen’s kappa was used to compare level of agreement between coders and verifier. A kappa >.6 was considered satisfactory agreement in this analysis. Themes with kappas below .6 were analyzed by the primary author to identify presence of the theme within each discrepancy coded comment. Additional trigger words arising from analysis of discrepancies in intercoder agreement were added to theme descriptions to increase robustness.

All students submit a site and preceptor evaluation electronically to the experiential education office at the end of each APPE. The evaluations include two questions where the student is asked to self-rate the amount of effort and learning occurring during the APPE, compared to prior experiences at other settings. Answer options for student learning scores range from 1 (student learned much less than or put much less effort into the completed experience compared to other experiences) to 5 (student
learned much more than or put much more effort into the completed experience compared to other experiences). A t-test was used to compare average scores from all APM Year 1 students to scores from all students at each APM site in the five previous years (historical comparison) and Year 2 (follow-up comparison).

Two other questions on the evaluation of site and preceptor that examine student ratings about their interprofessional team experience were added at the beginning of Year 1. One question examined the student’s role on the health care team during the APPE with answer categories of fully integrated (the student’s contributions and recommendations to the team were integral to team decisions and the student was a critical component of the care team), actively participating (the student made recommendations to the team which periodically influenced team decisions; the student was included but was not a critical component of the team), or passively listening (the student participated and learned with the team but did not make active contributions to team decisions; the student was an accessory/nonessential component of the team). A second question asked about the student’s perceived level of accountability for patient outcomes with the interprofessional team on the APPE, with answer categories of full accountability (the student shared accountability for patient outcomes with the team), partial accountability (the student occasionally shared accountability for patient outcomes with the team), or not accountable. A 3x3 Fishers exact test was used to compare independence in student self-scoring categories of health care team role and accountability for patient outcomes between APM sites, general medicine non-APM teaching sites, and non-teaching general medicine sites in the Seattle metropolitan area. Significant differences in the 3x3 independence test were further explored using 2x2 Fishers exact tests of subsets of the interprofessional role and accountability data to identify specifically where the differences were located.

The study protocol was reviewed by the University of Washington Human Subjects Division subcommittee and determined to qualify for exemption. All statistical analyses were performed using R, version 3.1.3 (The R Project, Vienna, Austria).

RESULTS

Twenty-two students in Year 1 and 29 students in Year 2 completed APMs at the two academic medical center sites, compared to a total of 35 students during the 5-year period prior to Year 1 (an annual average of seven students). Fourteen of the 15 students completing an APM experience prior to March of Year 1 were interviewed and 14 of the 23 students completing an APM experience prior to April of Year 2 were interviewed. Baseline characteristics of interviewed students are shown in Table 1. Of all interviewed students, 25% had no inpatient background other than their inpatient introductory pharmacy practice experience; all of these students had internship experience in a non-inpatient pharmacy setting.

Data from the interviews were categorized to characterize the model structure, the ease with which students adapted to the model, overall learning and effort by students in the model, the level of interaction with preceptors and the health care team, adequacy of preparation for the experience, and overall satisfaction.

Site A had four medical teams, with two teams each serviced by a student pharmacist, one team serviced by a resident pharmacist, and one team serviced by an attending pharmacist. After participating in rounds at both sites, the student pharmacist would discuss patients on service (referred to as “run the list”) with the attending pharmacist for 30 to 60 minutes at Site A and 1 hour at Site B. Topic discussions occurred during this session daily if there was time at Site A and about twice weekly to daily at Site B; topic discussion time depended on the patient load and preceptor teaching style. Student responsibilities at both sites included participation on rounds, following up with questions from the medical team, performing medication

| Table 1. Baseline Characteristics of Interviewed Students |
|---------------------------------------------------------|
| **Year 1**                                               | **Year 2**                                               |
| Site A n (%)                                             | Site B n (%)                                             |
| (n=9)a                                                   | (n=5)b                                                   |
| Site A n (%)                                             | Site B n (%)                                             |
| (n=7)a                                                   | (n=7)b                                                   |
| Prior internship in hospital                            | 6 (67)                                                   | 3 (43)                                                   |
| Had prior inpatient APPE                                 | 5 (56)                                                   | 3 (43)                                                   |
| Only prior inpatient experience is IPPE                  | 1 (33)                                                   | 1 (14)                                                   |

*aSite A hosted 15 students in Year 1 and 18 students in Year 2
bSite B hosted 7 students in Year 1 and 11 students in Year 2
reconciliation on newly admitted patients, dosing medications, teaching new anticoagulant patients, completing discharge counseling, and documenting these activities.

Students at Site A were expected in Year 1 to provide care to all patients on their service (about 10 patients) within the first two days; in Year 2, student pharmacists increased to the full service by the end of the first week. Student and resident pharmacists at Site B shared patient care for 10 to 20 patients daily. Student pharmacists reported spending 10 to 11 hours per day at Site A and 9.5 to 10 hours per day at Site B.

Themes emerging from answers to questions about student adaptation to the APM were pharmacy mentorship, prior inpatient experience, and degree of difficulty in adjusting to the experience (Table 2). Students reporting successful adaptation attributed it to mentorship by the resident and (when applicable) previous inpatient experience, whereas difficulty in adapting was attributed to lack of guidance by a resident or the attending pharmacist. Six students (43%) in Year 1 and seven students (50%) in Year 2 felt the attending pharmacist’s availability and/or the resident’s guidance were integral in orienting them to the experience. In Year 1, four of nine students (44%) at Site A and one of five students (20%) at Site B indicated that expectations could be better delineated and that they did not feel adequately supported. In Year 2, all students at both sites indicated they felt adequately supported by the resident and attending pharmacist.

Student self-rated learning scores at Site A averaged 4.5 in the five years prior to Year 1, 3.6 in Year 1 (p = .005), and 4.1 in Year 2 (p = .14). Site B average learning scores did not change over the same time periods (Figure 1). Student self-rated effort scores at Site A averaged 4.5 in the five years prior to Year 1, 4.1 in Year 1 (p = .11), and 3.9 in Year 2 (p = .02 compared to scores prior to Year 1). Site B did not change with average scores of 4.3 in the five years prior to Year 1, 4.4 in Year 1, and 4.3 in Year 2.

Thematic analysis of student interactions with the resident and attending pharmacist identified routine interactions, availability, and amount of time the preceptor spent with the student as factors affecting the student’s experience either positively (when present) or negatively (when absent) (Table 2). Another theme, independence, could be either positive (feeling trusted by preceptor) or negative (feeling abandoned by preceptor).

In Year 1, seven of nine students (78%) at Site A reported little or no interaction with a pharmacy resident versus one of five students (20%) at Site B. This changed in Year 2, when one of seven students (14%) at Site A and two of seven students (29%) at Site B reported having little interaction with a resident. Students highly valued their interactions with residents. Residents played a teaching role, orienting students to the site and explaining processes for completing tasks efficiently. Residents role modeled interacting with the team and with the attending pharmacist. Residents also coached students in writing care notes, verbally presenting patients to the attending pharmacist, and thinking logically and methodically through care decisions. The attending pharmacist played these roles in the absence of a resident, but was not able to interact as frequently with students as was the resident.

Most students quickly became comfortable with the medical team. Two themes emerged when students spoke of integration into the team. The first was reception of the student pharmacist’s therapy recommendations, with acceptance of recommendations as a marker for integration. The second theme was interpersonal interactions with other team members, with comments made about establishing rapport or having a connection to other team members marking integration.

The role that students played in the interprofessional team was different between teaching (ie, site has medical residency program) and non-teaching general medicine sites (Table 3). A larger proportion of students completing a general medicine APPE at an APM site (p < .001) and at a non-APM teaching site (p < .01) felt their role was fully integrated in the interprofessional team, compared to students at non-teaching general medicine sites. There were also differences between teaching and non-teaching sites in the accountability to the team that students felt for patient outcomes. A larger proportion of APM students (76%; p < .001) and students at non-APM teaching sites (58%; p < .05) felt fully accountable to the interprofessional team compared to students at non-teaching sites (32%).

Eleven of 14 students (79%) in both Year 1 and Year 2 stated they had adequate preparation to be successful on the APM. Fourteen of the 28 students (50%) named either their internship or completion of a prior APPE at one of the two medical centers as a significant contributor to being adequately prepared. Analysis of answers from students who did not feel adequately prepared yielded suggestions for more patient care encounters during IPPEs, pre-APPE training in use of electronic medical records, timed laboratory case work-ups that simulate pressures in the practice setting, laboratory cases with multiple complex patients to help students learn how to manage a high patient load, and more experience presenting a patient to a preceptor. Suggestions for improvement in school preparation from other students who felt prepared in some but not in all aspects included more case-based learning to help retain drug facts and more practice in locating information quickly.
Table 2. Adaptation to Attending Pharmacist Model and Student-Preceptor Interactions

| Theme                          | Kappa | Example                                                                                                                                 |
|-------------------------------|-------|------------------------------------------------------------------------------------------------------------------------------------------|
| Question 3: Tell me how the first week went for you. Pharmacy mentorship. Relates to how the pharmacy resident or attending pharmacist assisted or was unavailable to help the student adapt to the experience. | 0.84  | “During the first week, my preceptor threw me into doing rounds on my own so she wasn’t there to precept me. I was very nervous so that was my first week, just trying to get used to everything, basically break down my wall of being nervous from everything.” (Student 5, Site B) |
| Prior experience. Relates to how the student’s past experience or lack of experience affected the student’s acclimation to the experience. | 0.86  | “So first week during Gen Med a lot of, just, figuring out the system, and a lot of the learning the computers, learning where everything was, learning my responsibilities, learning how to follow-up patients. So my first week was mainly focused on the logistics of it. I tried the best I could to focus on therapeutics and clinical work, but really when you don’t know the system, and you don’t know the computers, and you don’t know your place it’s really hard to do that and so that’s what I focused on first week.” (Student 5, Site A) |
| Patient load. Relates to how the patient load during the first week impacted the student’s ability to positively or negatively acclimate to the experience. | 0.90  | “I think the first week was a bit overwhelming to start because being my second inpatient rotation, there was a pretty heavy inpatient load. I think we had an average of 14 or 16 patients to start and that was more than I’d been used to in the X service.” (Student 4, Site B) |
| Degree of adjustment. Relates to the difficulty or smoothness with which the student adapted to the experience. | 0.75  | “The first week went fine. So I did not have a resident working directly with me. There was another student who had a resident so my preceptor went on rounds with me on the first day, and after that I rounded independently with the medicine team. But yeah, I feel like the first week pretty smoothly.” (Student 7, Site A) |

Question 4, Part 1: Was it difficult acclimating to the environment?

| Pharmacy mentorship. Relates to how the pharmacy resident or attending pharmacist assisted or was unavailable to help the student adapt to the experience. | 0.70  | “No, I think really having the resident made my life a lot easier – being able to work with her, ease into the experience in a way that I wouldn’t have gotten through [without the resident].” (Student 6, Site A) |
| Prior experience. Relates to how the student’s past experience or lack of experience affected the student’s acclimation to the experience. | 0.70  | “I feel like it was all right integrating. I think I had more of a learning adjustment period the month prior [at this medical center]. The first week was definitely an adjustment, but it was kind of eased by the fact that I had been there at the previous month at a different rotation. (Student 7, Site A) |
| Degree of adjustment. Relates to the student’s internal level of comfort in adjusting to the experience. | 0.68  | “The resident was really good about just going through and saying, ‘When I work up a patient, I’m going to start here, go there, go there.’ And then pre-rounding with them really helped me to acclimate to that because I could see what she was doing since I was sitting right next to her. So that really helped.” (Student 1, Site A) |
Three out of nine students (33%) at Site A and no student at Site B in Year 1 indicated they would not recommend the experience to a pre-APPE student. All students at both sites in Year 2 stated they would recommend the experience, and most enthusiastically endorsed the model. Students who were adequately eased into the model and then allowed to function semi-autonomously by the end of the experience appeared to be the most satisfied with the experience.

**DISCUSSION**

Student experience in the APM was fairly similar to the traditional precepting model with the exception of the strong positive interactions with the resident, when a resident was available for student guidance. It is not necessary for student guidance to come from a resident, but residents may be uniquely suited for acclimating students to the inpatient setting, since residents can easily remember what it was like to be a student and being new to the inpatient setting. There was a higher likelihood that the student experience would not be positive if a resident was not on service, the attending pharmacist was too busy to provide guidance, and the student had little experience in the inpatient setting. In the current study, the contributions of the residents were invaluable to the success of the APM.

Students at teaching sites perceive themselves as more fully integrated into and accountable to the medical team for patient outcomes, compared to non-teaching sites. There was no difference between APM and non-APM teaching sites in either measurement; being in the teaching environment may make the student feel more

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**Table 2. (Continued)**

| Theme                                                                 | Kappa | Example                                                                                                                                 |
|-----------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------------------------------------------------|
| Question 6: Describe your daily interactions with the pharmacy resident and the attending pharmacist. |       | “So the resident, I interacted with the resident most of the time because she’s with me during rounding and things like that. So I interacted with her every day in the morning before rounding. And in the afternoon, I interacted with my main preceptor, talking to him about the patients and things like that and telling him what my plan is.”
(Student 6, Site B)                                                                                           |
| Routine interactions. Relates to daily interactions during a designated meeting time.                           | 0.67  | “But he was sitting right next to me, so if I had, you know, I had a question on a patient’s asthma medications, I could just turn to him and be like ‘this is the problem, this is the patient, what do I do?’ So he’s available for that and he was also available for any logistics, like, ‘I need to fax this to this place, how do I do that?’ He was there for that.”
(Student 3, Site A)                                                                                           |
| Availability. Relates to the resident and/or attending pharmacist accessibility when the student had questions or needed help. | 0.68  | “I was mostly with the resident for the entire day and then the afternoon was when I was interacting with the preceptor unless she had questions or we had questions for her, we could always call her.”
(Student 7, Site B)                                                                                           |
| Amount of time spent. Relates to any mention of time spent with student pharmacist by the resident or preceptor. | 0.72  | “So normally, besides the first day, I would kind of pre-round independently and go on rounds independently. And then after rounds, I would check in with the pharmacist a little bit. I worked independently for probably most of the time during the day but we always met up for probably at least an hour, half an hour maybe, to run through my list of patients. And then sometimes, if time allows, do topic discussions.”
(Student 7, Site A)                                                                                           |
| Independence. Relates to the amount of time spent working independently during the experience.                  | 0.75  |                                                                                                                                         |
integrated in and accountable to the interprofessional team regardless of precepting model. An unanticipated benefit was a comparison of two similar but slightly different APMs. Model supervisors at each of the medical centers had thought that the APMs were identical in structure. Only through interviews was it determined that the model structure at Site A was different from the model structure at Site B, and that difference affected quality of learning. Most students at Site A in Year 1 did not have any resident support and nearly half of the students felt their attending pharmacist wasn’t very approachable, because the pharmacist was so busy with his or her own patients. These factors may have contributed to the lower student-perceived learning in Year 1 at Site A compared to the previous five years under the traditional preceptor model. Student-perceived learning did not change at Site B, where students worked closely with the resident to run the service, and students may have had lengthier interactions with the attending pharmacist on average compared to Site A. Two changes made by APM supervisors prior to Year 2 were increasing the support of students by residents and attending pharmacists and decreasing student initial patient load at Site A. Student learning scores at Site A in Year 2 were higher than in

Figure 1. Average student-reported learning scores at the end of the APM experience for Year 1 and Year 2 of model implementation. Pre-Year 1 comprised answers to the question from the five years prior to model implementation. *p=.005 for Year 1 as compared to Pre-Year 1.

Table 3. Student Self-rated Role in and Accountability to the Health Care Team

| Student Self-rated Role on the Health Care Team | Students at APM Sites n (%) (n=53; 2 sites) | Students at non-APM teaching sites n (%) (n=49; 4 sites) | Students at non-teaching sites n (%) (n=50; 6 sites) |
|------------------------------------------------|------------------------------------------|-------------------------------------------------|---------------------------------|
| Fully integrated                                | 40 (75)*                                 | 29 (59)*                                        | 14 (28)                         |
| Actively participating                          | 13 (25)                                  | 18 (37)                                         | 30 (60)                         |
| Passive listening                               | 0                                        | 2 (4%)                                          | 6 (12)                          |

| Student Self-rated Accountability for Patient Outcomes Shared With Health Care Team | Students at APM Sites n (%) (n=53; 2 sites) | Students at non-APM teaching sites n (%) (n=46; 4 sites) | Students at non-teaching sites n (%) (n=50; 6 sites) |
|-------------------------------------------------------------------------------------|------------------------------------------|-------------------------------------------------|---------------------------------|
| Full accountability                                                                 | 41 (77)*                                 | 28 (61)*                                        | 16 (32)                         |
| Partial accountability                                                             | 11 (21)                                  | 14 (30)                                         | 27 (54)                         |
| No accountability                                                                  | 1 (2)                                    | 1 (2)                                           | 7 (14)                          |

APM = attending pharmacist model
*Significantly different from students at non-teaching sites (p<.05)
Year 1 and students during interview stated they felt adequately supported by the resident and attending pharmacist, so it appears that the changes to the model at Site A were successful.

While the attending physician model is relatively consistent across medical centers, the study results suggest that APMs will vary between sites. The structure of an APM will depend upon the number of medical teams being serviced, and the number of pharmacists, residents, and students on service. Although APM implementation may initially appear limited to large academic medical centers with multiple pharmacy residents, it is possible that a smaller non-teaching hospital with one to two residents could create an APM-like experience for students where the student is placed with the resident, rather than with a care team or service, and does whatever patient care experience the resident is scheduled to do during the student’s time at the site. In the APM described by Delgado and colleagues, one attending pharmacist precepted five to six pharmacy students and there did not appear to be a resident layer between student and attending pharmacist. Anecdotally, the APM structure described by Delgado and colleagues has been used for many years by health-system pharmacies, so APMs may be more widespread than previously thought and are only gaining a new label.

As with any APPE, care must be taken to ensure that the student is appropriately acclimated to the APM experience. Delgado and colleagues reported an acclimation need when their pharmacists determined they needed to provide modeling, coaching, and competency checking for students in patient interviewing, profile review, and discharge counseling, before students could uniformly perform these functions independently. Data from the current study suggest that students without much hospital experience may have a steeper learning curve or harder time adapting to this model. However, several students with only community pharmacy internship experience embraced this model enthusiastically and performed well. The keys to a successful learning experience will be active dialogue with the students about their learning experience, particularly in the first week at the site, and flexibility to increase support when students indicate they are feeling overwhelmed. Regardless of the APM implemented, it will be important for sites to clearly identify their performance expectations for students and ensure that students receive adequate support in the first few days of the experience.

In this pilot version of the APM, the two general medicine sites increased the number of students hosted annually by a factor of 3 to 4, averaging seven students per year prior to APM implementation and increasing to 22 students in Year 1 and 29 in Year 2. The increase in capacity at these sites combined with the higher percentage of students being fully integrated into the health care team compared to other practice models support the suggestion by the 2015 American Association of Colleges of Pharmacy (AACP) Professional Affairs Committee that this learning model “may provide greater access to high quality experiential education for student pharmacists.”33

There are several limitations to this study. Because only half of potential APM students were interviewed in Year 2, it is possible that their experiences were different from APM students who were not interviewed. However, saturation was achieved in data collected from interviewed students and the site evaluations from all Year 2 APM students did not indicate problems existed. Data about student role and accountability to the interprofessional team were not available prior to Year 1 of the study, so it is not possible to explore if the APM increased student role and accountability to the interprofessional team at the two APM sites. Student competency in task completion was not tested, so it is unknown whether the APM improves student abilities over other practice models. Preceptor interviews were not conducted in this study, so there is no information about the preceptor or resident experience to provide context for the student experience. Finally, future work collecting data through in-depth interviews with students at other general medicine sites will allow comparison of the student experience in the APM to other general medicine clinical teaching models.

In-depth interviews of students, preceptors, managers/administrators, patients/caregivers, and other stakeholders can provide a rich source of data about experiential education quality and educational program assessment. Data from in-depth interviews in this study enabled site problem identification and tested whether implemented strategies appeared to solve the problem. All experiential education programs collect quantitative data about sites and preceptors from evaluations and likely also collect qualitative data about student learning. The value of these qualitative data should not be ignored or marginalized as such data can identify successes and problems in practice-based education. Qualitative research techniques are useful for identifying “the ifs and buts in the chain of causation.”34 These techniques contribute robustly to an effective quality improvement strategy for experiential education programs, but will require significant time and resource investment so projects will need to be planned strategically.
CONCLUSION

The APM provided a high-quality learning experience, increased site capacity for students, and may have advantages over the traditional preceptor model for incorporating students into the interprofessional team. Supervisors at APM sites should communicate with students early in the APPE to determine how students are acclimating to the service and modify the support structure when students are struggling. It will be important for APM site supervisors to provide experiential education programs with some detail about performance expectations and model structure, so that students know what to expect and will be more comfortable at the site.

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