RESEARCH

Pharmacotherapy Scholars Program— Intensive Longitudinal Training to Enhance Post-Graduate Readiness

James C. Coons, PharmD [a-b]; Neal Benedict, PharmD[a-b]; Amy Seybert, PharmD[a-b]; Carlo J. Iasella, PharmD, MPH[a-b]; Susan J. Skledar, RPh, MPH[b]; Randall M. Smith, PhD[b]; Melissa Saul, MS[c]; Christopher R. Ensor, PharmD, BCPS-AQ Cardiology[d]

[a] UPMC Presbyterian-Shadyside Hospital, Pittsburgh, PA
[b] University of Pittsburgh School of Pharmacy, Pittsburgh, PA
[c] University of Pittsburgh School of Medicine, Pittsburgh, PA
[d] At time of writing, University of Pittsburgh School of Pharmacy, Pittsburgh, PA

Submitted August 10, 2018; Accepted March 18, 2019

Corresponding author:
James C. Coons, PharmD, FCCP, BCCP
Pharmacy and Therapeutics Department
Salk Hall, Room 727
3501 Terrace Street
Pittsburgh, PA 15261
Phone: 412-648-3088
Fax: 412-624-8715
Email: coonsjc@upmc.edu

Objective. To describe the design, curricular integration, and evaluation of an innovative approach to successful placement into post-graduate pharmacy training programs, and student preparation for direct patient care activities.

Methods. The Pharmacotherapy Scholars Program is an intensive training experience integrated into the Doctor of Pharmacy curriculum as an Area of Concentration. The Program is designed to prepare fourth professional year students at the University of Pittsburgh School of Pharmacy to become highly proficient in a direct patient care role and to successfully match into post-graduate training programs. The PSP integrates synchronous advanced pharmacy practice experiences with personal advising, team-based mentoring, peer-to-peer learning, longitudinal research, and professional development. Program goals were modeled after the Accreditation Standard for Postgraduate Year One (PGY1) Pharmacy Residency

Programs. Distinguishing features of the Program are the scope and rigor of student assessments, research focus, and scholarship opportunities.

Results. A total of 68 students have completed the Program (2013-2018). The overall residency match rate was 91%. Student performance on both the knowledge and clinical skills assessments were significantly increased. There was an approximate 15% increase in knowledge and 30% increase in clinical skills based on comprehensive readiness assessment and an intermittent clinical examination which used patient simulation, respectively.

Conclusion. The Pharmacotherapy Scholars Program is an innovative training program designed to enhance Doctor of Pharmacy student preparation for advanced clinical training. Our Program has achieved a high PGY1 residency placement rate while demonstrating significant improvements in pharmacotherapy knowledge and clinical skills in direct patient care activities.

Keywords: residency, post-graduate, assessment, training, readiness

INTRODUCTION

Over the past decade, pharmacy leadership organizations have advanced a vision for the expansion of residency training in order to meet the demands of complex medication use in evolving health care environments.[1-3] The American College of Clinical Pharmacy's (ACCP) position statement advocates for pre-requisite residency training prior to entry into direct patient care roles by the year 2020.[2] Similarly, the American Society of Health-System Pharmacists (ASHP) had established a vision that 90% of new pharmacists entering hospital and health-system practice would have completed accredited residency training by 2015.[1] The American Association of Colleges of Pharmacy (AACP) has advocated for schools of pharmacy to take proactive leadership roles in developing and enhancing residency programs.[3] This collective vision for advancing pharmacists as direct patient care providers recognizes the value of residency training to the individual, the organization, our profession, and most importantly to the patient.

According to 2018 data from the National Matching Services, over 5,500 applicants participated in the ASHP Match for postgraduate year one (PGY1) training programs. Among this cohort, the applicant match rate for both phases I and II was 65%.[4] The number of available positions in the Match for PGY1 programs has increased by approximately 30% since 2013. However, the Match rate has only increased by about 5% during that time despite an approximate 40% increase in applicant participation in the Match.[4] These data underscore the ongoing demand and competition for post-graduate pharmacy residency training.

Match rates at PittPharmacy have historically been above the national average, however, opportunities still exist to increase the rigor and preparation for students committed to pursuing post-graduate residency training. This endeavor closely aligns with AACP accreditation standards which maintain that graduates be "practice-ready" and "team-ready."[5] A 2010 survey of Colleges of Pharmacy to assess curricular preparation for residency training showed that while many schools have activities that promote residency training to students, very few have designated curricular residency preparation programs.[6] This manuscript describes the design, curricular integration, and evaluation of an innovative approach to both successful placement of students into post-graduate pharmacy training programs, and preparation of students for direct patient care activities.

METHODS

The Pharmacotherapy Scholars Program (PSP) is an intensive training experience integrated into the PharmD curriculum as an Area of Concentration (ARCO), beginning in the Spring Semester of the third professional (P3) year. An ARCO is an elective educational opportunity provided to PharmD students to pursue an area of personal interest during their curriculum. There are currently eight ARCOs at the University of Pittsburgh School of Pharmacy (PittPharmacy). PittPharmacy is committed to the education of all students in research and scholarship, in patient care, and in service to our communities. Assessment and Academic Performance Committees have rigorous standards to ensure that all students meet these expectations. The ARCOs are an extension of our curriculum and one of many strategies that provide students with a personalized educational experience.

The PSP ARCO is designed to prepare fourth professional year (P4) students to become highly proficient in a direct patient care role and to successfully match into post-graduate training programs. The PSP integrates synchronous advanced pharmacy practice experiences (APPEs) with personal career advising, team-based mentoring, peer-to-peer learning, longitudinal research, and professional development. The initial design of the Program in 2013 was modeled, in part, after the ASHP Accreditation Standard for PGY1 Pharmacy Residency Programs (of which the competency areas, goals, and objectives were a part)Table 1.[7] The PSP leadership team, consisting of two PSP program directors, two pharmacy operations leads from our academic medical center, the Director of Experiential Learning and Continuing Professional Development, the Department Chair of Pharmacy and Therapeutics, the Senior Associate Dean of the School of Pharmacy, and an education support specialist, meet regularly to review ongoing learner performance, address programmatic issues, and adapt and plan for future program initiatives.

Application Process

Application into the PSP is competitive as students in the Fall semester of their P3 year apply for entry. Offering the PSP in the P3 year, in contrast to earlier years, provides students more time to identify their preferred career path since the Program requires prerequisite courses, structured APPEs, and a research project which align with the P4 year. Eligible applicants must have attained a GPA $\geq$ 3.0 in the professional pharmacy curriculum (first, second, and third years of the four-year program) and demonstrate a commitment to pursuing post-graduate pharmacy training. The GPA threshold represents a minimum expectation for academic performance and was adapted from screening criteria for pharmacy residency candidates at our institution. The application process is designed to reflect components of the residency selection process, including submission of a letter of intent, two letters of recommendation, an academic transcript, and current *curriculum vitae.* Applicants are then invited for interviews before a panel that includes program directors, preceptors, and current PSP students. The interview is scheduled as a two-hour session and includes the following components: program introduction, case review and completion, panel interview, and case de-briefing with a preceptor. Applicants are scored by the PSP leadership team using a

rubric weighted equally in three areas (application, interview, and case performance) to create a rank-order list of the candidates.

Coursework

Upon acceptance into the PSP, students are required to complete two prerequisite courses in the Spring term of the P3 year. One course entitled, "Acute Care Simulation," is designed to improve students' knowledge and critical-thinking skills in the management of acutely ill patients using online independent learning coupled with human patient simulation cases.[8] Evaluation of this course, published previously, demonstrated enhancement in students' knowledge and acute care critical-thinking skills while also improving learning satisfaction.[8] The intent of this course as a pre-requisite to the PSP is to improve student's patient care knowledge and skill preparedness prior to entry into advanced clinical practice on APPEs. This course is open to any student in the P3 year, however, there is limited capacity and students in the PSP are given first preference. The second pre-requisite course, entitled "Discovering Scientific Inquiry," is a mentored experience in outcomes research design and methodology. This course prepares students to collaborate on the design and execution of an outcomes-based clinical research project. Students are expected to learn fundamentals of hypothesis generation and research aims, study design and methods, proficiency in basic biostatistics and use of statistical software, development of a study proposal, and fundamentals of the institutional review board (IRB) process. The intent of this course as a prerequisite to the PSP is to improve student preparedness for developing and completing an outcomes-based clinical research project during their P4 year. This course is open only to those students in the PSP.

APPEs: Patient Care Focus

While all PittPharmacy students are motivated to assume the roles and responsibilities of the profession, students in the PSP are encouraged to engage as "stakeholders" in the medication use process and are responsible for patient outcomes under the direction of pharmacist mentors and preceptors. During the first week, students complete an orientation to the PSP during which clinical skills development and baseline clinical assessments occur. The goal of the orientation is to facilitate student progression to more complex, and eventually real patients. APPEs are highly patient care-focused and personalized to the needs

and interests of the student. The APPEs are selected by PSP leadership to provide comprehensive exposure to advanced pharmacy practice in both the acute care and ambulatory care environments, and reflect the variety of direct patient care experiences that a PGY-1 resident will complete during their training. The APPEs are concentrated, but not exclusive, to UPMC hospitals. All students at the School of Pharmacy are required to complete eight, five-week APPEs. For the PSP students, the core PSP APPEs include: institutional (hospital/health-system), acute care - internal medicine, acute care - critical care/cardiology, ambulatory care, community practice, and a sub-specialty acute care experiences (i.e., transplant, oncology, emergency medicine, etc.). As much as possible, APPEs are sequentially designed so that foundational experiences (i.e., institutional, internal medicine) are scheduled prior to more complex and specialized patient care experiences (i.e., transplant, critical care/cardiology). In addition to the core APPEs, PSP students have two electives of their choice within any of the above categories, typically choosing additional direct patient care experiences, or they can choose a "pure" elective (e.g., international, research). The PSP students have their "off" block scheduled to coincide with their potential residency interviews.

As noted above, the PSP students are required to eight, five-week APPEs. Blocks one through four, which span from May through late September, are required to be completed locally (i.e., greater Pittsburgh area) so that all students are on-site for active participation in the longitudinal research project. Students progress through each APPE block in groups of up to four, and this cohort also serves as their research workgroup. This structure promotes collaboration, peer-to-peer learning, and cooperative problem-solving. Communication among all students and preceptors in the PSP is further solidified through an email listserv and website (scholars.pharmacy.pitt.edu).

Research and Scholarly Work

In addition to patient care experiences, PSP students also have significant research and scholarship opportunities. Students are expected to engage in clinical research by participating in the collaboration, design, and execution of a longitudinal research project. The project initiates in their scientific inquiry class in the P3 year, and continues throughout their P4 year. This goal supports the vision of the PSP to develop clinical research skills and prepare for entrance into post-graduate training. The design is structurally similar

to the conduct of a PGY-1 research project, except that students work directly with their peers in collaboration. Research projects are mentored by a team that includes the PSP co-directors, a clinical data scientist, a research fellow, and other mentors based on clinical and research expertise. Research faculty are also invited on an *ad hoc* basis to present brief seminars on clinical research related to project topics. Our partnership with UPMC has enabled us to conduct clinically relevant research projects which address important questions that align with initiatives to improve patient care. Project topics are selected and assigned by the PSP leadership. A clinical data scientist serves as the honest broker (neutral third party acting on behalf of the research team) for the projects, providing de-identified data once IRB approval occurs. Patients are identified through an electronic medical record data repository that contains full-text medical records and integrates information from central transcription, pharmacy, laboratory, finance, administrative, and other departmental databases.[9] Students work in groups, typically on larger-scope projects that are then further divided into smaller-scope projects with specific aims. For example, a single project may be undertaken by eight students, half of whom will address a safety question whereas the other half will address an effectiveness question. Progress meetings for all students occur weekly throughout the P4 year to further their research and to develop problem-solving, data collection skills, and proficiency in project management. Students also learn fundamentals of IBM SPSS Statistics 25.0 (IBM, Inc, New York, New York) for data analytics and statistical testing. The primary deliverable of the research project is the development of an abstract and poster suitable for presentation at the ASHP Midyear Clinical Meeting. Thereafter, the expectation is that a manuscript is drafted and eventually submitted for peer review in an appropriate biomedical journal based on the clinical content.

Professional Development Series

A third component of the PSP is the inclusion of a formal professional development seminar series tailored to address necessary clinical, research, academic, and post-graduate preparations. The PSP Professional Development Series complements program goals to prepare students to become highly competitive applicants for post-graduate residency training. These seminars occur once or twice monthly throughout the P4 year and include the following topics: selecting and preparing for pharmacy residency

training, career planning, clinical practice and research opportunities, *curriculum vitae* and letter of intent preparation and review, interview skills and mock interview sessions, ASHP Midyear Clinical Meeting planning and preparation, and manuscript writing and refereeing, . Additionally, the PSP hosts an external speaker each year focused on pharmacy residency training. The professional development series helps to advance one of the primary goals of the PSP, which is to help students successfully place into a PGY-1 program.

Progressive Assessment of Student Knowledge and Skills

A critical and distinguishing feature of the PSP is the scope and rigor of student assessments. During the PSP orientation week, each student completes a baseline comprehensive knowledge-based examination (readiness assessment) which was developed by clinical content experts under the direction of the leadership team. This is a 250-question, multiple-choice format, which covers the following therapeutic and practice domains: ambulatory care, critical care, cardiology, internal medicine, and either oncology or transplant. This examination is administered electronically to evaluate foundational knowledge in those practice areas. Each student receives the scores on their examination, including a breakdown of their performance on each domain. However, they do not receive answers to individual questions. The feedback provides an opportunity for students to focus their efforts on reviewing therapeutic areas which require improvement before starting clinical APPEs. At the conclusion of the PSP, students complete the same examination in order to evaluate change in knowledge (overall and by practice domain) over the course of the year. The overall pre- and post-exam scores were compared using the paired t-test.

An intermittent clinical examination (ICE) is also integrated throughout the PSP to further evaluate student's direct patient care skills and prepare for case-based components to PGY1 interviews. The ICE is an objective structured clinical examination which requires the student to evaluate a patient assigned by the preceptor, including data collection and synthesis, problem identification, and presentation of treatment recommendations. This was developed by clinical preceptors under the direction of the PSP leadership. Students are given 60 minutes to complete a patient review that is new to them, followed by a 15 to 20-minute verbal presentation including time for questions and feedback. A standardized rubric is used to

evaluate the presentation and interpretation of subjective and objective data, development of the pharmacotherapy plan with associated monitoring, and effectiveness of the student's communication to the preceptor. A Likert scale is used to evaluate each element of the rubric using the following scale: needs improvement, satisfactory progress, and achieved. Table 2 provides a summary of the key elements regarding pharmacotherapy plan development of the ICE. A baseline ICE is completed during the first week of the initial APPE using a blended case with human patient simulation. Feedback is then provided directly to each student about their performance. An ICE is also administered during the final week of the following APPEs: ambulatory care, critical care/cardiology, internal medicine, and sub-specialty. Review of ICE performance with the student occurred immediately after their presentation. Results were then shared with the PSP co-directors and then aggregated by student. Feedback could then be compiled and sent to subsequent preceptors to improve program development. A follow-up ICE using the same baseline case at the simulator is completed at the conclusion of the PSP to capture overall change in clinical skills performance. A pre- and post-ICE evaluation of clinical performance was evaluated. Scores were compared using the paired t-test. An evaluation of the effectiveness of the PSP, including the aforementioned assessments, was approved as exempt research by the University of Pittsburgh Institutional Review Board.

Each of these assessments are unique to students in the PSP, even though all PittPharmacy students complete rigorous assessments to meet professional and accreditation expectations. Student performance on these school-wide assessments between ARCOs is not compared since each of these programs vary considerably in their goals, objectives, and performance indicators.

Performance during APPEs was evaluated using the same rubric and platform for all PittPharmacy students. Performance was categorized for different knowledge and clinical domains, linked to our curricular outcomes, based on the following mastery scale: awareness, beginning competence, intermediate competence, and proficient. Evaluations were completed at the mid-point and conclusion of the APPE. For students that had multiple preceptors on a given APPE, feedback on student performance could be shared.

RESULTS

Since Program inception in 2013 through 2018, a total of 68 students have completed the PSP. Figure 1 shows the number of enrolled students by year and the growth of the Program over time. Our current class size is 16 students, although the number of applicants has nearly doubled over the past two years. Over the past two years we have had 21 and 24 applications for an acceptance rate of 76% and 67%, respectively. The overall match rate with a PGY-1 residency program was 91% (range, 75-100%). All students matched with PGY-1 acute care programs. Figure 2 summarizes the match rate by Program year. Student placement to a PGY-1 residency based on their preferred (highest-ranked) program also steadily increased from 25% in 2014 of the PSP to 75% by 2017. As with all student pharmacists, matching with the highest-ranked program is based on the student's personal preference and considers many factors such as program quality, reputation, and geographical preference.

An evaluation of student preparation for direct patient care activities, before and after completion of the PSP, is illustrated in Figures 3 and 4. Student performance on both the knowledge and clinical skills assessments demonstrated significant increases from start to end of program. There was an approximate 15% increase overall in the knowledge-based examination (Figure 3). The clinical skills score based on the encounter at the patient simulator was increased by approximately 30% (Figure 4).

Research completed thus far have been retrospective cohort studies of electronic health records involving large data sets (typically > 5,000 patients) designed to evaluate comparative effectiveness and safety outcomes. Research projects have included cardiovascular (i.e., antiplatelet therapies for patients undergoing percutaneous coronary intervention, pulmonary arterial hypertension medications), critical care, nephrology, and infectious diseases-related topics. To date, all students have presented posters at national meetings, resulting in a total of nine presentations at the ASHP Midyear Clinical Meeting and three at the ACCP Virtual Poster Symposium. Of note, each poster presentation represented the work of three to four students who worked as a team. One manuscript has been published in full in a peer-reviewed journal, and four others are currently either under peer-review or are in the manuscript development phase.[10]

DISCUSSION

The PSP is a rigorous training program for Doctor of Pharmacy students that are committed to post-graduate residency training. It supports the collective professional vision for the advancement of pharmacists as "practice-ready" direct patient care providers through completion of a residency program.[1-3] Specifically, the PSP focuses on student preparation for securing a PGY1 residency program in a highly competitive environment. The success of the Program in meeting this goal is evident through the high PGY1 match rates relative to national averages.[4]

Our Program aligns with efforts to better integrate students into direct patient care and develop responsibility for medication therapy outcomes.[11] Key assessments evaluating patient care knowledge and performance showed progressive learning. Significant improvements were observed in both pharmacotherapy care plan development and monitoring, as well as comprehensive knowledge over the course of the Program.

The generalizability of the PSP to post-graduate residency training experiences was bolstered through the design and sequence of APPEs, structure and timing of assessments, and integration of research and professional development. The PSP is structured using a sequential APPE design which incorporates both traditional individualized and team-based precepting. This design leverages capacity for multiple learners and minimizes inefficiencies to the student and preceptor that would otherwise occur through re-training. Similar sequential APPE designs, or "complete-block scheduling," have been described at other institutions and shown to be successful.[12, 13] Student advantages to these programs include: increased learning satisfaction, enhancement of problem-solving skills, and increased ownership of patient outcomes. Students that participate in this type of APPE design also are capable of extending pharmacy services and providing more clinical interventions.[12,13] Other models have focused on collaborative programming, including workshops and mock interviews, to enhance student preparation for the residency application and selection process, which was also well-received.[14,15] There are other examples of clinical track approaches which combine requirements for coursework, focused clinical APPEs, participation in a clinical skills competition, and completion of a skills checklist.[16,17] A survey of student perception was the most commonly reported tool to demonstrate overall impact among residency preparation programs.[15] However,

few programs reported residency match rates or other formal outcomes.[14,15,18] The PSP integrates elements of each of the aforementioned examples with a sequential APPE design coupled with structured programs and coursework to improve student preparation for successful placement and transition into post-graduate residency training programs. Our program also reports program impact through both residency placement and student learning.

The PSP training environment emulates certain aspects of the residency experience, including use of comprehensive and rigorous assessments to guide focused and timely feedback for students. This provides further evidence of the fidelity of the PSP training environment relative to a PGY1 residency experience. Data gathered from both knowledge-based and clinical skills-based assessments offer greater insight into the student's areas of strength and opportunities for improvement. The clinical skills assessments rely on a blended approach through use of both direct patient care and human patient simulation scenarios. Information about each student's performance can also be shared with the precepting team to foster more personalized learning and mentorship. The baseline clinical skills and knowledge assessments also present an opportunity to address student readiness, which may be seen as a potential barrier to student involvement in direct patient care.[11]

Additionally, students in the PSP have the opportunity to work closely with pharmacy residents, thereby gaining valuable first-hand exposure to the residency experience. Residents, in fact, serve as primary preceptors for the internal medicine experience for several of the PSP students and also share co-precepting responsibilities on several other core APPEs. Residents in the primary preceptor role provide formative and summative assessments of the students. The preceptor mentorship conferred by the consistent and organized interactions with residents is a clear advantage of the PSP.

The longitudinal research project requirement is a unique experience provided by the PSP relative to other published clinical track approaches, and another example of a core part of a PGY-1 residency program. The goals of the research requirement in the PSP is to teach students fundamental concepts in the design and conduct of clinical research, and to develop skills needed for effective analysis and interpretation of data. The outcomes research projects leverage large data sets to conduct comparative effectiveness and/or

safety analyses. Students gain valuable experience in data management, analysis, and interpretation. They also learn to navigate the peer-review process as their project progresses toward a completed manuscript. The exposure to the publication process has been shown to influence the likelihood of future scholarship, therefore providing another advantage for students that are committed to career advancement in clinical pharmacy and research.[19] Project mentors have also realized more scholarship and academic productivity through the investment of time and effort with these larger scale research projects.

The PSP also integrates a robust professional development series which provides student exposure to a diverse network of clinical, research, academic, and administrative experts. Invited speakers are current PittPharmacy faculty as well as external individuals with national expertise and reputation in their areas of practice or research. The majority of the sessions are dedicated to preparation for residency training. We have also been able to leverage a highly engaged group of alumni and PSP graduates. These individuals have become PSP mentors and preceptors and continue to expand our PSP network and reputation.

The success of the PSP, as evidenced through the high residency placement rate (Figure 3), has led to significant program growth over the past five years. Figure 4 illustrates the expansion in the number of students that have been accepted into the PSP. Additionally, we have expanded the number of preceptors and sites, both at UPMC and outside of UPMC, in order to provide students with exposure to new and diverse clinical settings and practice models as the Program expands.

While the PSP has grown considerably, so has competitiveness for entry into the Program. Despite this increase in demand, we plan to maintain our current class size of 16 students for the 2018-19 academic year. Current limitations to further expansion include our ability to ensure sufficient high quality APPEs, provision of rigorous assessments, personalized mentorship, and execution of multiple longitudinal research projects for a larger number of students. The PSP is also relatively resource intensive, as it requires dedicated time from program co-directors, school and institutional leadership, clinical preceptors, and research mentors. To meet these challenges while addressing the growing demand, an evaluation of Program expansion is ongoing. As we continue to evaluate the current state and future design of the PSP, it is important to note that all PittPharmacy students are afforded opportunities to personalize their education

by pursuing clinical, professional, and research mentorship. For example, students have access to professional development series and the same APPEs that those participating in the PSP would typically complete. Finally, all PittPharmacy students have opportunities to work with faculty to engage in research and quality improvement activities. The main distinction with the PSP is the structured design for students to actively engage in clinical, professional, and research-related activities.

CONCLUSION

The PSP was designed to enhance Pharm.D. student preparation for advanced clinical training. The Program is built and sustained on a collaboration between PittPharmacy, UPMC leadership, and the network of preceptors across our region. We have achieved a high placement rate among our graduates into competitive post-graduate residency programs. Furthermore, our experience demonstrated significant improvements in pharmacotherapy knowledge and clinical skills in direct patient care activities. Therefore, our Program provides a successful model which could be used to advance Pharm.D. education, training, and placement of students into residency programs and patient care career paths.

ACKNOWLEDGEMENTS

The authors would like to acknowledge all of the preceptors who have been instrumental in the establishment and growth of the Pharmacotherapy Scholars Program. UPMC leadership is acknowledged, including Alfred L'Altrelli, Pharm.D., Janine Then, Pharm.D., and Joan Mapel, Pharm.D. We also acknowledge UPMC clinical preceptors, Bonnie A. Falcione, Pharm.D., BCPS (AQ-ID) and Deanne L. Hall, Pharm.D., CDE, BCACP, in particular for their contributions to Program development in their respective areas of practice. We would also like to acknowledge the support of the Experiential Learning Program at the University of Pittsburgh School of Pharmacy, notably the efforts of James J. Pschirer, Pharm.D. Finally, we are most grateful to Susan M. Parnell for her role in administrative support of the Program.

REFERENCES

1. American Society of Health-System Pharmacists. ASHP long-range vision for the pharmacy work force in hospitals and health systems. *Am J Health-Syst Pharm* 2007;64:1320-30.
2. Murphy JE, Nappi JM, Bosso JA, Saseen JJ, Hemstreet BA, Halloran MA, et al. ACCP position statement. American College of Clinical Pharmacy's vision of the future: Postgraduate pharmacy residency training as a prerequisite for direct patient care. *Pharmacotherapy* 2006;722-33.
3. Lee M, Bennett M, Chase P, Gourley D, Letendre D, Murphy J, et al. Final report and recommendations of the 2002 AACP task force on the role of colleges and schools in residency training *Am J Pharm Educ*. 2004;68(1):Article S2.
4. National Matching Services, Inc. ASHP Match Statistics. Available on-line at: https://www.natmatch.com/ashprmp/stats.html. Accessed 02/11/2019.
5. Accreditation Council for Pharmacy Education (ACPE). Accreditation Standards and Key Elements for the Professional Program in Pharmacy Leading to the Doctor of Pharmacy Degree. Available online at: https://www.acpe-accredit.org/pdf/Standards2016FINAL.pdf. Accessed 08/30/2017.
6. Dunn BL, Ragucci KR, Garner S, Spencer A. Survey of colleges of pharmacy to assess preparation for and promotion of residency training. Am J Pharm Educ 2010;74(3):Article 43.
7. American Society of Health-System Pharmacists (ASHP). Required Competency Areas, Goals, and Objectives for Postgraduate Year One (PGY1) Pharmacy Residencies. Available online at: https://www.ashp.org/-/media/assets/professional-development/residencies/docs/required-competency-areas-goals-objectives. Accessed 11/29/17.
8. Seybert AL, Kane-Gill SL. Elective course in acute care using online learning and patient simulation. Am J Pharm Edu 2011;75(3):Article 54.
9. Yount RJ, Vries JK, Councill CD. The medical archival retrieval system: an information retrieval system based on distributed parallel processing. Inf Proc Manag 1991;27:379-89.
10. Coons JC, Iasella CJ, Chanas T, Wang N, Williams K, Boyd A, et al. Comparative effectiveness and safety analysis of dual antiplatelet therapies within an integrated delivery system. Ann Pharmacother 2017; 51(8):649-655.
11. Rathbun RC, Hester EK, Arnold LM, et al. Importance of direct patient care in advanced pharmacy practice experiences. Pharmacotherapy 2012;32(4):e88-97.
12. Hatton RC, Weitzel KW. Complete-block scheduling for advanced pharmacy practice experiences. Am J Health-Syst Pharm 2013;70:2144-51.
13. Taylor RA, Wisneski S, Kaun MA, et al. Sequential advanced pharmacy practice experiences at one institution for students from three pharmacy schools. Am J Health-Syst Pharm 2014;71:140-4.
14. Rider SK, Oeder JL, Nguyen TT, et al. A collaborative approach to residency preparation programming for pharmacy students. Am J Health-Syst Pharm 2014;71:950-5.
15. Hidayat L, Huggins CE, Venugopalan V, Berrios-Colon E. Preparing students to enter the race for postgraduate training. J Pharm Pract 2017;30:476-82.
16. New J, Garner S, Ragucci K, Spencer A. An advanced clinical track within a doctor of pharmacy program. Am J Pharm Educ 2012;76(3):Article 43.
17. Gauthier TP, Morrison C. Comment on "an advanced clinical track within a doctor of pharmacy program." Am J Pharm Educ 2012;76(5):Article 95.
18. Koenigsfeld CF, Wall GC, Miesner AR, et al. A faculty-led mock residency interview exercise for fourth-year doctor of pharmacy students. J Pharm Pract 2012;25:101-07.
19. Morris CT, Hatton RC, Kimberlin CL. Factors associated with the publication of scholarly articles by pharmacists. Am J Health-Syst Pharm 2011;68:1640-5.

Table 1. Pharmacotherapy Scholars Program Domains and Learning Objectives[7]

Domain	Learning Objective
Direct Patient Care	Assume responsibility for providing pharmaceutical care to service patients in collaboration with the preceptor.
	Prepare for and attend daily multidisciplinary patient care rounds.
	Provide pharmaceutical care to service patients, and in doing so, be recognized as the source of quality drug information and pharmacotherapeutic recommendations.
	Establish a patient-centered relationship between the pharmacist and patient and/or caregiver.
	Provide relevant medication education to service patients including addressing the importance of adherence, indication, adverse effects, and health maintenance.
Drug Information	Provide accurate, timely, and clear responses to drug-information requests from the service.
	Formulate a search strategy, recover and assess primary and/or secondary literature for its applicability to the patient/question, and deliver a response to the preceptor and subsequently to the requestor.
	Evaluate the usefulness of biomedical literature gathered pertaining to questions related to the care of service patients (e.g., literature review, case conference, etc.).
	Evaluate the usefulness of biomedical literature gathered pertaining to enhanced knowledge in the field (e.g., journal review, journal club, etc.).
	Develop a library of materials, individually or as assigned.
Medication Therapy Management	Collect accurately the patient's medications and ascertain the degree to which the patient has been adherent to their regimen.
	Determine the presence of medication therapy problems in a patient's current medication regimen.
	Assess the adequacy of individual patients' pharmacotherapy daily and formulate patient-centered recommendations related to the rational use of pharmaceuticals which may include, but not be limited to, regimen optimization (addition, modification, or deletion), cost-containment, access to medications, patient understanding and competency, and adherence.
	Use pharmacokinetic and dynamic principles when formulating the aforementioned recommendations to dose and monitor drug therapy.
	Re-visit previously formulated recommendations and plans, assess their continued validity, and augment as needed to achieve patient-centered therapeutic goals.
	Utilize an organizational mechanism that is simple, comfortable to the learner, repeatable, and produces accurate transcription of information.
Communication	Document patient care activities in accordance with institutional policies and procedures under the direct supervision of the preceptor.
	Interface with clinical and operational-based pharmacy personnel to ensure accurate and timely care and provision of critical information necessary for patient care.
	Provide both a verbal and written sign-out of service patients and responsibilities to the oncoming scholar for the rotation.
	Deliver education to other pharmacy-based learners, such as clinical pharmacists and other APPE students, and other medicine-based learners, such as nurses, nurse practitioners, physician assistants, and physicians.
Research	Design and implement quality improvement changes to the institution's medication-use system.
	Conduct a practice-related project using effective project management skills.
	Design, execute, and report results of investigations of pharmacy practice-related issues.

Professional Development	Evaluate roles and responsibilities of successful clinical, research, academic and post-graduate programs and their preceptors. Prepare self-assessment of readiness for application to post-graduate programs, including patient care, research, teaching, and service acumen.

Table 2. Key Elements of Intermittent Clinical Examination

Development of Pharmacotherapy Plan
Relates prioritized patient specific problem list
Addresses all drug-related problems
Recommends evidence-based medication therapy for all problems
Recommends correct dose for all medication therapies
Recommends most appropriate route of administration for all medications
Recommends appropriate duration of therapy for all medications
Development of Monitoring Plan
Recommends appropriate monitoring parameters for all therapeutic plans
Recommends appropriate monitoring interval for all therapeutic plans
Communication
Demonstrates confident, persuasive presentation of patient care issues
SOAP note outlines therapeutic plan effectively and efficiently

Each element rated according to scale of Achieved, Satisfactory Progress, or Needs Improvement

Table 3. Student Performance on Knowledge Examination (Readiness Assessment)

	Pre-PSP Score	**Post-PSP Score**	***p* value***
	M (SD)	M (SD)	
Readiness Assessment	161 (20)	184 (16)	<.001

PSP=Pharmacotherapy Scholars Program

*Paired t-test

Total possible score of 250 points

Data represent 27 student exams (2016-18; note that one student did not complete the post-assessment)

Table 4. Student Performance on Clinical Examination

	Pre-PSP Score	Post-PSP Score	*p* value*
	M (SD)	M (SD)	
Clinical Examination	12.4 (3.7)	16.2 (3.2)	.002

PSP=Pharmacotherapy Scholars Program

*Paired t-test

Total possible score of 28 points

Data represent 15 student exams conducted at patient simulator (2017-18; note that one student did not complete the post-assessment

Figure 1. Pharmacotherapy Scholars Program – Student Enrollment and Expansion

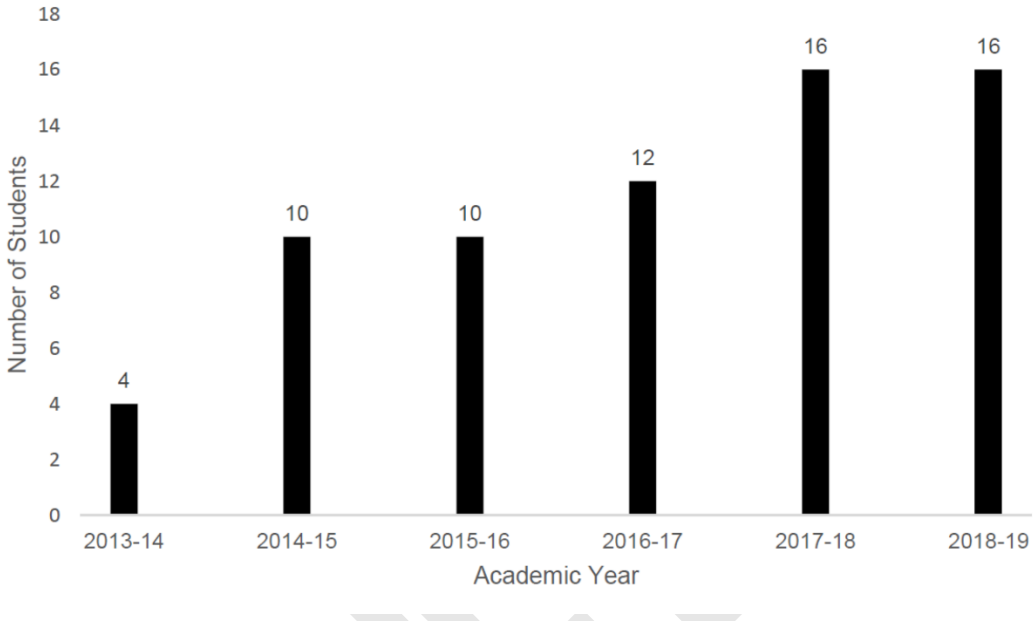

Figure 2. Pharmacotherapy Scholars Program – PGY-1 Match Rate