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The Importance of Research during Pharmacy Residency Training

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Abstract

Practice-related projects and pharmacy practice research are requirements to complete postgraduate pharmacy residency programs. Many residents will complete residencies without fully developing the skills needed to perform research required for new clinical and academic positions. Many studies have quantified successes and identified characteristics that may be associated with successful resident publication. There are many benefits to gaining research and publication skills during residency training for the resident, preceptor/mentors, and the residency program. Published works have also suggested approaches that can be taken to improve research

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within a residency program. The aims of this article are to discuss the publication rates of resident research projects, suggest ways to improve residency research, review benefits of residency research, and briefly review research training alternatives.

Keywords

Resident; Research; Publication rates

Introduction

Pharmacists who possess clinical pharmacotherapy knowledge and research skills are essential to the generation of new knowledge and the practice of clinical pharmacy.^{1,2} Developing these pharmacists to advance the pharmacy profession and compete for extramural funding is an important component of the American College of Clinical Pharmacy (ACCP) strategic plan.^{3–5} However, limited research education is required in the curriculum of Doctor of Pharmacy (PharmD) degree programs.^{6–8} While basics in biostatistics and research design is required, application of these research skills is not.^{6–8} Further, longitudinal research experiences are not routinely available to students.⁹ Regardless, student participation in a research project is unlikely to develop the research competencies necessary to complete high quality research. Postgraduate education is often necessary to train pharmacists before entering careers with research expectations. We aim to: 1) identify publication rates in residency programs and characteristics which may improve publication success, 2) discuss the importance and benefits of gaining research and publication skills during a residency program, 3) suggest ways to improve residency research, and 4) discuss alternative training programs aimed to improve research skills.

Postgraduate Training: Fellowship and Residency

Pharmacy internships were established to train pharmacists to become managers of pharmacy services in hospitals.¹⁰ The term internship was officially changed to residency in 1963 when the American Society of Hospital Pharmacists published the first accreditation standards for pharmacy residencies to ensure organized and standardized experiences with focus on clinical practice.¹¹ Formal research training programs designed for clinical pharmacists, termed fellowships, were first developed in the 1970's.¹⁰ Pharmacy fellowships focused on developing abilities to conduct independent research in a particular area of specialization. In 1987 seven national pharmacy organizations convened to establish definitions of pharmacy residencies and fellowships and to clarify the objectives of these training programs.¹⁰ Residencies were defined as “an organized, directed, postgraduate training program in a defined area of pharmacy practice”. Fellowships were defined as a “directed, highly individualized, postgraduate program designed to prepare the participant to become an independent researcher.”¹⁰

In 1985, ACCP reported that there were 91 fellowship positions offered by 83 programs in the United States¹² while ASHP reported availability of 184 accredited residency programs.¹³ These 267 programs (about one fellowship for every two residencies) were available for 5,147 new graduates with Bachelor of Science in Pharmacy degrees and 812

graduates with PharmD degrees.¹⁴ Since that time, national pharmacy organizations advocated more strongly for the completion of residency training, thus setting the expectation that all entry-level pharmacists participating in direct patient-care activities complete residency training.^{15–17} Subsequently, the number of available residency positions has expanded. According to the 2014 ASHP Resident Matching Program, 1,333 programs offered 3,156 residency positions.¹⁸ Interest in residency training continues to outgrow availability as 1,614 candidates were unsuccessful in matching with a program in 2014 despite the growing number of residency positions. However, fellowships have not experienced similar growth in numbers or demand. According to ACCP, 54 programs offered 107 fellowship positions in 2014, which is fewer programs than in 1985.¹⁹ Residency positions now outnumber fellowships 29 to 1. This decline may be due to a lack of consistent funding or interest in these programs.⁴ Pharmacists are not often required to complete fellowships as a prerequisite for most entry level clinical or academic positions, even if research is an expectation of the position. Ultimately, 1–2 years of residency training has become the most common pathway to becoming a pharmacist with research responsibilities. In fact, a survey of ACCP members found that approximately two-thirds of respondents working in positions with heavy research responsibilities did not have formal research training.²⁰ While many individuals have been very successful in their research career despite minimal formal training, the question remains about the best way to meet these educational needs of trainees.

Research Requirements during Residency

As with PharmD programs, it is unreasonable to expect pharmacists to be prepared to function as independent researchers after completion of residency training, given the limited focus and time dedicated to development of research skills. Residents are required to complete a practice-related project during ASHP accredited residencies; however, completion of a research project is not a uniform requirement.^{21,22} The current standards do not require research training be provided during the completion of a residency. Residents are expected to present their project outcomes either through preparation of a manuscript or during a residency conference; however, submission of a manuscript to a biomedical journal for publication is not required. Publication rate is a measurable and consistent outcome to assess research training and experience during residency, but there are benefits of resident research outside of publication. Publication of pharmacy resident research projects is low and the number of publications does not appear to be increasing despite the rise in residency positions.^{23–28} There is much that can be learned from the current state of resident research including their publication rate and residency-trained individual's publication contributions to biomedical journals in the ensuing years after residency completion.

Resident Publication Success Rates

Previous authors have attempted to determine publication success for pharmacy residents. Murphy and Downhour determined publication success based on the results of questionnaires sent to RPDs during the 1999–2000 residency year.²⁹ Information was collected on 917 resident projects from 278 returned questionnaires (a 62% response rate). Based on the RPD response, 121 projects (13.2%) were published. Using MEDLINE and

International Pharmaceutical Abstracts (IPA), McKelvey and colleagues assessed residency publication success at the Southeastern Residency Conference in years 1981, 1991, and 2001 to assess changes over time.²⁴ Of the 272 abstracts evaluated, 43 (15.8%) were published. Publication success decreased over time with rates of 20.0% (1981), 15.7% (1991), and 12.5% (2001). An analysis by Olson and colleagues assessed every third abstract presented at the Western States Conference during 1995, 2000, and 2005 using MEDLINE and EMBASE.²³ A total of 270 abstracts were assessed with an overall publication rate of 6.3% (n=17). The rate of publication appeared to increase in subsequent years analyzed from 4.2% in 1995 to 8.2% in 2005, but still remained low. Publication rates were assessed after presentation at Western States Conference again in 2008 using only MEDLINE.²⁵ Of the 446 abstracts presented, 19 were published (4.3%) within approximately two years. Publication rates of pharmacy residents in Canada were also assessed.²⁶ Resident research was identified using residency program websites, brochures, hand-searching within the library, and by contacting RPDs between 2000 and 2009. Of the 518 projects identified, 107 projects (20.7%) were published as full-text manuscripts, as identified through EMBASE. The Ohio State University School of Pharmacy assessed resident publication success before and after implementation of a practice-based research network (PBRN) for their residents.³⁰ The publication to resident ratio increased from 0.25 (1997–2001) to 0.56 (2002–2007) after implementation of the PBRN. A random sample of abstracts from regional and national pharmacy meetings between 2004 and 2007 showed an overall publication rate of 9.4% for pharmacy residency projects.³¹ Most recently, Stranges and colleagues assessed the publication success of residents presenting at the Great Lakes Pharmacy Residency conference in 2003, 2005, and 2007 using Scopus, IPA, and MEDLINE (Pubmed).³² Over this period of time, 11.4% (n=76) of abstracts were published.³² Comparing publication rates between studies is cautioned because of heterogeneity in populations and years studied. Further, the database search strategy varied between studies and validity of each strategy cannot be confirmed. Recently Kwak and colleagues found that a consistent search strategy using author names, key words from abstracts, and both Pubmed and EMBASE databases improved sensitivity (93%) and specificity (100%) of identifying pharmacy resident publications.³³ It is also important to allow adequate time from abstract presentation to capture publication.

These authors have also attempted to identify resident project characteristics which resulted in publication. PGY-2 resident abstracts had a higher success rate (30.8%) of publication when compared to PGY-1 resident abstracts (10.5%); $p=0.0185$.²⁵ Projects with results reported in the abstract were more likely to be published compared to abstracts which describe methods only (10.2% vs. 3.5%; $p=0.0461$).²⁵ Cross-sectional study design ($p=0.001$) and academic-affiliated residencies ($p=0.002$) also appeared to improve chances of publication success.³² Other papers discussed trends in successful publications without inferential statistics. It was noted that having a physician coauthor and presenting the abstract at a national versus a regional meeting may contribute to the publication success of resident projects.^{24,26,31} These observations may suggest strong mentorship, established research teams, or subjecting resident research to more peer review may improve publication success. Use of a structured research program aimed to improve residency research success also appeared to improve publication success.³⁰

Publication of a research project is considered to be highly challenging with many barriers to publication. Insufficient time is considered one of the biggest barriers to completing pharmacy residency projects.^{34–36} In a perspective on residency publications, it was noted that only 3.5% of potential pharmacy resident projects were submitted to the *American Journal of Health-System Pharmacists* for publication with an acceptance rate of 14%.³⁷ Low submission and publication rate may be a result of poor research design, unoriginal projects, or not completing a research manuscript.^{27,28,37} Small study samples often result in insufficient power to detect differences and make meaningful conclusions. Residents often have inadequate time to devote to research and complete a meaningful project within one year. Residents may also approach a project with the thought that their research will not be publishable. The research abilities of resident preceptors and RPDs may also influence the success of their residents.

The Benefits of Publication during Residency Research Training

Publication of residency projects may be beneficial in a variety of ways. First, residents who publish may be able to distinguish themselves from other residents which may broaden their career opportunities, regardless of whether they are seeking an academic position. Second, resident research can be valuable to the medical and pharmacy community as a whole. Answering unique research questions may contribute to improvements in the care of patients or result in development of new roles for pharmacists. If these projects are not carried through to completion, valuable knowledge may not be disseminated. Third, a resident who submits for publication learns the research process, an appreciation for the time and effort required to follow through on a project from inception to publication. Fourth, a successful publication can instill pride in the resident, preceptor(s), and program for the hard work over the previous year(s). A resident who publishes may have opportunities to present/discuss their work and may be more likely to be approached as a collaborator for future projects. Additionally, gaining this experience during a training program may increase the comfort level with the research and publication process which may lead to subsequent scholarly activity. A residency program with research successes may be more favorable when recruiting new residents particularly for those considering a future career in academia. Fifth, inadequate training in research is thought to be a contributing factor to faculty burn-out.³⁸ Improved research skills and publication experience for pharmacy residents pursuing academic careers may improve faculty retention.³⁸ Sixth, publication of a resident's project gives recognition to the mentors and others who have helped with the project. Recognition as a co-investigator on projects can help with the academic or professional promotion of residency directors and preceptors. This may help justify the time and effort needed to make sure projects are of a quality suitable for publication.

The Benefits of Residency Research Outside of Publication

There are many benefits of pharmacy resident research beyond publication. Ellis and colleagues found subjective improvements in research knowledge, skills, and abilities among residents surveyed before and after residency. However, the same improvements were not seen when objectively measured with a pre- and post-test.³⁹ Bookstaver and colleagues similarly found resident understanding of biostatistics was poor after completion

of residency, possibly highlighting the need for improvements in the resident research training experience.⁴⁰ Programs also derive benefit from resident research. In a 1999 survey of RPDs, Murphy and Downhour found resident projects, regardless if original research, service-development, or problem-solving are valuable to the resident and institution.²⁹ Swan and colleagues detail additional benefits of residency training programs in an annotated bibliography. Although not specifically tied to research projects, pharmacy residents provide improved clinical outcomes and cost savings to the host institution.⁴¹

Improving Residency Research

Completion of a pharmacy residency has become the most common path for pharmacists prior to assuming advanced practice positions, many of which have research expectations. Without formal research training, there still may be avenues available to improve the level of research training during residencies. These include research advisory groups, resident research curriculums and timelines, adept research mentorship, and creating a culture of research.

While residencies cannot replicate the fellowship training experience, some aspects can be emulated. This training model includes instruction/experience in hypothesis generation and development, study design, protocol development, project management, data collection, data analysis and interpretation, presentation of results, manuscript preparation, and publication. RPDs should periodically evaluate how robust of a research experience their residency provides. The type, quality, and publication rate of resident research may act as a marker for residency experiences. Other factors to consider include research resources (access to study populations, data and information technology, and statisticians), preceptor expertise and training, resident feedback, and degree of collaboration within the department, institution, and with other programs. Swanowski and colleagues describe a successful 'mini-fellowship' embedded into a PGY1 residency at University of Minnesota. Two PGY1 residents met weekly for three hours throughout the year to complete a set research curriculum. Under the guidance of a senior research advisor, the two residents were able to present three completed research projects at national meetings and submit five papers for publication during the year.⁴²

To assist in assessing and improving resident research experience and outcomes, many programs are creating more structured research experiences. Baker and colleagues describe a voluntary residency advisory group comprised of pharmacy practitioners experienced in research and scholarly activity.⁴³ Residents complete a research curriculum which guides them through steps in developing a research project start to finish. A research timeline ensures projects are completed in a timely manner. Pruchnicki and colleagues describe a similar program in a community/ambulatory care program.³⁰ Olson and colleagues created a Clinical Pharmacy Research Team for their ambulatory care PGY2 program at a large integrated healthcare system.⁴⁴ In addition to providing a research curriculum, which is open to both residents and preceptors for continuing education, their research team also assists in initial project planning prior to residents beginning the year which ensures projects are feasible and align with organization goals. Such programs result in increased poster presentation, manuscript submission, and publication.^{30,43,44} Success is aided by access to a

large research-intensive healthcare systems, consultative services (e.g., Center for Biostatistics, School of Public Health, and Office of Research), grant monies, or course offerings to a Masters in Health Sciences Program. These research experiences demonstrate the commitment these programs have to training research skills and lead to improvements in resident scholarly activity. Institutions without as many research resources, such as community hospitals, could consider collaborating with nearby residency programs to provide similar research advisor groups or training experiences.

Program directors should seek out preceptors with a record of independent research success and expertise in the area of investigation. Qualified preceptors and research mentors are critical for a valuable research experience, so programs should incorporate preceptor development in the areas of research for project mentors. Mentors need to be able to assist on the formulation of research questions, protocol design, analysis of results, and presentation of research findings. Guidance and support from experienced researchers can be beneficial for subsequent positions. Preceptors with scholarly activity expectations may approach resident research mentorship differently than those without. It is assumed that mentorship from preceptors with incentives aligned with the resident's will result in a more rigorous scientific approach research and a project more suitable for publication.

In addition to advisory panels or research curriculums, a culture of research can also be created to improve resident research importance and experience. Peer evaluation improves accountability and may improve publication success.³¹ Requiring presentation of research methods and results will hold the resident accountable for the quality of research and provide opportunities to receive valuable feedback. Submission of a manuscript should be a minimum expectation for residents, with the goal being publication. There are increasing opportunities for residents to complete the publication process. Program directors, project preceptors, and residents should become familiar with journals which may be appropriate for resident research. Many local journals dedicate sections that may be more suitable for resident research. The *Journal of Health-System Pharmacy Residents*, which offers opportunities exclusively for pharmacy residents to publish their scholarly work, will now be published as a supplement to the *American Journal of Health-System Pharmacists (AJHP)* under the title *AJHP Resident Edition*.⁴⁵ These dedicated sections may not share the same requirements as original research submissions. While this might not result in raising the bar for quality of resident research projects, it may provide the opportunity for residents to complete the process and achieve success with publication. Scholarly achievements by current and past residents should be celebrated and promoted. One excellent example is The University of Pittsburgh Residency program. Their website clearly displays research performed by previous residents and displays resident's project abstracts online.⁴⁶ This can allow future and current residents to understand preceptors' areas of interest in research and an understanding of research expectations for the program. At the St. Louis College of Pharmacy, an awards program was started to incentivize performing and presenting high quality research. The recipient of the award is selected by a reviewing body of faculty and presented during an annual residency research symposium. This may provide an additional incentive for residents and preceptors to dedicate time and efforts to developing a high quality product.

Lack of time to complete a full research project in one year does impact quality of resident research. One strategy that has been used by residency programs to increase completion of multi-year studies is to pass on completion of the research from the outgoing to incoming resident. This method does require some coordination to ensure enough projects are available to provide residents a complete experience and assumes incoming residents will be vested in the ongoing research. Conflicts determining authorship or lack of interest in the project can effect completion.

The ultimate responsibility for gaining the most from the research experience lies with the resident. Because residents will be spending a great deal of time and effort on their projects, they should consider research questions that are of interest to them and project preceptors who they can work closely with over the course of the year. Residents should consider the preceptor's research and mentoring history, as well as gain a clear understanding of the expectations for the project. Prior to embarking on research, residents should consider all potential projects and perform a cursory literature search to understand the background and foreground information. The resident is encouraged to meet with project preceptors and seek further clarification early and often during the research process. Residents should be active and well-informed in all steps of the research process.

Post-Residency Research Training Alternatives

In some cases, clinical pharmacists may not have received adequate research training during their residency or completed a residency program. There are several alternatives by which pharmacists can receive research training. Fellowships are still available for pharmacists who want to focus on research; however, there has been a reduction of fellowship programs in the United States. This reduction in fellowship programs may be due to a lack of consistent funding or interest. In conjunction with, or independent of, a fellowship, pharmacists can participate in postgraduate or dual-degree programs culminating in a Master of Science (M.S.), or Doctor of Philosophy (PhD) degree. These opportunities may be difficult for some as it may take several years to complete these training programs. Professional pharmacy organizations also provide research training programs. ACCP and the ACCP Research Institute offers two certificate programs and traineeships for research.⁴⁷ The Research and Scholarly Academy targets residency-trained pharmacists to develop basic clinical research and scholarly abilities. The Mentored Research Investigator Training (MeRIT) Program is a new program that will begin in 2015. Its aim is to develop investigators through a two year mentored research program using accomplished research mentors. Similarly, the ASHP foundation offers Research Bootcamp that aims to aid in the development of pharmacists with practice-based research skills through distance education and experiential programs.⁴⁸ The ASHP Foundation also offers an online toolkit to its members.⁴⁸ Pharmacy organizations can foster improved research skills through increasing access to such post-residency research training opportunities discussed above and continuing to offer research programming at national, regional, and local meetings. Accrediting bodies can also influence research training of pharmacists through incorporating more research-focused standards or encouraging adoption of research curriculum during residency training.

Conclusion

Residency research projects are a very important component of PGY-1 and PGY-2 training. Many barriers exist which may prevent successful publication of research projects. Identifying and improving on these barriers may ultimately improve publication success which can be beneficial to the residents, mentors, institutions, and practice of pharmacy. Whether a program director, mentor, or resident, an understanding of the characteristics of successful resident research can be a useful tool. Understanding and implementing resident research accomplishments can improve a resident's understanding of the research process and culminate in improved resident research success. The focus of residency training remains on the development of clinical practitioners, but a meaningful experience in the development and execution of a research project may better prepare residents for additional development opportunities later in their careers.

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Abbreviations

ACCP	American College of Clinical Pharmacy
ASHP	American Society of Health-Systems Pharmacists
FINER	feasibility, interesting, novel, ethical, relevant
MeRIT	Mentored Research Investigator Training
PBRN	practice-based research network
PharmD	Doctor of Pharmacy
PICO	population, intervention, control, outcome
PGY	post-graduate year
RPD	residency program director

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