Changes in Pharmacy Residency Training Design Between 2012 and 2017: A Perspective of Academic Medical Centers

Hospital Pharmacy
2018, Vol. 53(2) 113–120
© The Author(s) 2017
Reprints and permissions:
sagepub.com/journalsPermissions.nav
DOI: 10.1177/0018578717738509
journals.sagepub.com/home/hpx

Anne Krasniak¹, William Darko¹, Christopher D. Miller¹,
Robert Seabury¹, and Luke A. Probst¹

Abstract

Purpose: The role of health-system pharmacists continues to expand, and this area of pharmacy practice increasingly requires augmented baseline training. It is unclear how Post Graduate Year I (PGY-I) pharmacy residencies may be changing to meet these needs. The objectives of our survey were to describe PGY-I pharmacy residency program design among academic medical centers, characterize program changes enacted over 5-year period, and describe career paths among PGY-I pharmacy residency graduates. **Methods:** A 32-item questionnaire was developed independently, which was reviewed and validated by 4 residency program directors. The survey was uploaded to an online survey tool and sent electronically to residency program directors of 109 Vizient academic medical centers with PGY-I pharmacy residency programs. Residency program directors were identified from a list of Vizient-participating hospitals. The survey was re-sent at 2-week intervals on 4 occasions to improve response rates. SPSS version 23.0 was used to analyze the data. **Results:** Overall, 49 (45%) of hospitals responded to the survey. Survey responses showed statistically significant increases over the 5-year survey period in the following areas: the number of PGY-I resident positions offered ($P = .001$), percent of time spent on teaching experiences ($P = .001$), and percentage of PGY-I residents pursuing PGY-2 or fellowship training ($P = .026$). **Conclusion:** We found that PGY-I pharmacy residency programs at Vizient academic medical centers have undergone limited changes over the 5-year survey period and substantial variation exists between program designs. The most common change to program design was an increase in the percentage of time residents spend on teaching experiences. There was an increase in residents pursuing PGY-2 or fellowship training, which may suggest a shift toward increased specialization in clinical pharmacy practice or may reflect changes in the availability of job opportunities.

Keywords

education, residency training/programs, pharmacists

Introduction

According to the American College of Clinical Pharmacy position statement on the vision of the future of pharmacy, direct patient care will be the standard for future pharmacy practice.¹ Given that assumption, the position statement affirms that residency training should become a prerequisite for entry into pharmacy practice by 2020. The American Society of Health-System Pharmacists (ASHP) has committed to the goal that all new college of pharmacy graduates with direct patient care responsibilities will be required to complete an ASHP-accredited PGY-I pharmacy residency by the year 2020.² More recently, ASHP's consensus document from the Pharmacy Practice Model Initiative Summit recommended "pharmacist completion of ASHP-accredited

residency training or achievement of equivalent experience" as part of an optimal pharmacy practice model and that successful implementation of such pharmacy practice models would require increased numbers of residency-trained pharmacists.³ Furthermore, certain positions, particularly hospital clinical/staff pharmacist positions, are increasingly perceived to require a PGY-I pharmacy residency as an entry level requirement.^{4,5} This change is likely due to the expanding

¹Upstate University Hospital, Syracuse, NY, USA

Corresponding Author:

William Darko, Upstate University Hospital, 750 East Adams Street,
Syracuse NY 13210, USA.
Email: DarkoW@upstate.edu

role of health-system pharmacists and the increasing availability of PGY-1 pharmacy residency-trained pharmacists.⁴ Despite all of these trends, there are limited data to describe current PGY-1 program designs and how programs may be evolving in recent years to meet the changing landscape of acute care pharmacy practice. To gain understanding of these issues, we developed a survey with the following primary objectives: (1) to describe current residency program design at academic medical centers; (2) to discuss changes made to residency programs over the 5-year survey period; and (3) to characterize PGY-1 pharmacy residency graduate career choices over the 5-year survey period.

Methods

Study Design

A list of Vizient-participating academic medical centers with ASHP-accredited PGY-1 pharmacy residency programs in the United States as of January 1, 2017, was compiled. Vizient University HealthSystem Consortium is the largest and most comprehensive network of academic medical centers in the United States. Vizient was utilized as a means for obtaining a list of academic medical centers in the United States.⁶ Residency program director e-mails were identified using the ASHP Online Residency Directory. A total of 109 Vizient academic medical centers with ASHP-accredited PGY-1 pharmacy residency programs were identified.

Survey Development and Content

A 32-item questionnaire was developed by the authors. The questionnaire was reviewed by 4 external residency program directors to ensure clarity of the survey questions. The survey was revised based on feedback from the reviewers. The questionnaire is summarized in the appendix. For the purposes of this survey, staffing was defined as any time spent in pharmacy operations, order validation, or a dispensing role. Internal medicine was defined as inpatient adult or general medicine. Academic medical centers were selected to survey in an effort to investigate a targeted group of institutions with similar clinical practice environments.

The survey was divided into 3 sections, each of which contained questions that fulfilled the study's objectives. The first section contained questions to assess PGY-1 pharmacy residency program demographics and design. The second section contained questions that assessed key changes that have occurred within the pharmacy residency program over the 5-year survey period. The 5-year survey period was defined as the 2011-2012 residency academic year to the 2016-2017 residency academic year. These questions were asked in pairs and sought to evaluate different characteristics of the programs over the 5-year survey period. The third section sought to characterize future training and career paths among PGY-1 pharmacy residents. These questions

were also asked in pairs and asked about different PGY-1 pharmacy resident career path choices during the 5-year survey period.

Survey Administration

The survey was granted an exemption by the Institutional Review Board at our institution. The final survey was uploaded to an online survey tool and was e-mailed to PGY-1 pharmacy residency program directors within the Vizient academic medical centers with an invitation to complete the survey. The survey was initially distributed in January 2017 and 4 additional reminder e-mails were sent at 2-week intervals to those who had not completed the survey to improve overall response rates. All survey responses were completely anonymous.

Statistical Analysis

All data were aggregated and analyzed using IBM SPSS version 23.0 (IBM Corporation, Chicago, Illinois). Statistics were selected based on the distribution of the data. Descriptive statistics were used to present the results. Data were nonnormally distributed and were analyzed by the Wilcoxon signed rank test and reported in median and interquartile range. All tests were 2-tailed and a *P* value of less than .05 was chosen for statistical significance.

Results

Of the 113 Vizient Academic Medical Center members, 109 had ASHP-Accredited PGY-1 pharmacy residency programs. Forty-nine (45%) programs responded to the survey. Five responders did not have a PGY-1 pharmacy residency program for a full 5 years prior to the survey and were excluded from data analysis. Table 1 displays the characteristics of the hospitals and residency programs among included responders. The hospitals varied in size, ranging from 200 beds to ≥ 1000 beds. Most pharmacy residency programs had been ASHP accredited for greater than 15 years (70.5%). Table 2 displays required and elective learning experiences, which varied greatly between pharmacy residency programs. The majority ($\geq 50\%$) of pharmacy residency programs required residents to rotate through internal medicine, administration, orientation, critical care, research, ambulatory care, and pharmacy operations learning experiences.

The number of PGY-1 pharmacy resident positions offered increased over the 5-year survey period from a median of 4 to a median of 5 positions ($P = .001$, Figure 1). The percentage of time spent on teaching experiences also increased over the 5-year survey period from a median of 5% to a median of 10% of time ($P = .001$, Figure 2). The percentage of time spent on internal medicine and elective learning experiences varied greatly among residency programs. Residents spent a median of 10% of time on internal medicine learning experiences and a median of 40% of time on elective learning experiences. Overall

Table 1. Survey of Residency Programs: Institution and Residency Program Characteristics.

Institution bed number	N (%)
200-299	3 (6.8)
300-449	3 (6.8)
450-599	8 (18.2)
600-799	12 (27.2)
800-999	10 (22.7)
≥1000	8 (18.2)
Years residency program accredited by ASHP	N (%)
≤1 year	1 (2.3)
1-5 years	2 (4.5)
6-10 years	2 (4.5)
11-15 years	8 (18.2)
≥15 years	31 (70.5)

Note. ASHP = American Society of Health-System Pharmacists.

Table 2. Survey of Pharmacy Residency Programs: Residency Program Learning Experiences.

Required learning experiences		
>75%	50-75%	<50%
<ul style="list-style-type: none"> • Internal medicine/ adult medicine • Administration • Orientation • Critical Care 	<ul style="list-style-type: none"> • Research • Ambulatory care • Pharmacy operations 	<ul style="list-style-type: none"> • Drug information • Pediatrics • Infectious disease • Medication safety • Cardiology • Emergency medicine • Anticoagulation • Family medicine • Oncology • Informatics • Transplant • HIV/AIDS
Elective learning experiences		
>75%	50-75%	<50%
<ul style="list-style-type: none"> • Oncology • Emergency medicine 	<ul style="list-style-type: none"> • Infectious disease • Cardiology • Transplant • Critical care • Ambulatory care 	<ul style="list-style-type: none"> • Pediatrics • Pharmacy informatics • Psychiatry • Anticoagulation • HIV/AIDS • Drug information • Endocrinology/ diabetes • Women's health • Internal medicine • Geriatrics • Medication safety • Research • Family medicine • Administration • Pharmacy operations • Other

we did not find a change in the percentage of time residents spent on either of these areas over the 5-year survey period ($P = .858$, $P = .699$), respectively. While there has been some increase in staffing requirements over the 5-year survey period, from a median of 14% to a median of 15% of time, this finding was not statistically significant ($P = .086$). Percent of time residents spent on research experiences over the 5-year survey period remains the same at a median of 10% of time ($P = .34$).

Resident career path choices did change significantly over the 5-year survey period. Our results demonstrated an increase from a median of 50% to a median of 70% of residents pursuing PGY-2 or fellowship training after completing PGY-1 pharmacy residency ($P = .026$, Figure 3). The survey showed a decrease in pharmacy residents that accepted a hospital-based clinical/staff position in the year directly after PGY-1 residency training, from a median of 50% to a median of 30% ($P = .014$, Figure 4). Fewer than 5% of residents were found to go directly into academia or ambulatory care practice sites immediately following PGY-1 residency training, and this did not change over the 5-year survey period.

Of the residency programs that responded to the survey, 54% require either PGY-1 pharmacy residency training or 3 years of hospital work experience as a minimum qualification for a hospital staff pharmacist position. Of those institutions, 29% require PGY-1 pharmacy residency training and 25% require either PGY-1 pharmacy residency or at least 3 years of hospital work experience. The survey showed that 32% of institutions did not require any hospital or residency experience as a minimum qualification for a hospital staff pharmacist position. The remaining 14% of institutions replied "none of the above" or "other," which some responders specified that qualification requirements were "PharmD with residency preferred," "depends on the position," or "6 months of hospital experience."

Discussion

As pharmacy practice at academic medical centers continues to evolve, we sought to understand how PGY-1 pharmacy residency programs might also be adjusting. Although our survey results reveal some significant changes in specific areas, consistent large-scale changes are not evident over the 5-year historical period. While significant changes have been occurring within individual programs, many of these changes did not transcend across programs.

The most common change to program design was an increase in the amount of teaching experiences provided to PGY-1 residents. This was the only program design change that was found to be significant. We found a near doubling of these types of learning experiences occurring over the 5 year survey period. This could likely be due to a number of factors. First, the updated ASHP Competency Area, Goals, and Objectives document was approved in 2014 which incorporated new goals and objectives for teaching, education, and dissemination of knowledge for PGY-1 pharmacy residency programs.⁷ The timing of this

Figure 1. Survey of residency programs indicating median number of residents: 2011-2012 residency academic year vs 2016-2017 residency academic year.

Note. The error bars in Figure 1 represent the interquartile range.

Figure 2. Survey of residency programs indicating median percentage of time residents spent on teaching experiences: 2011-2012 residency academic year vs 2016-2017 residency academic year.

Note. The error bars in Figure 2 represent the interquartile range.

occurred roughly halfway through the 5-year survey period and likely had an impact on the amount of time residents spent on teaching experiences at many programs. Second, the number and size of pharmacy colleges have continued to expand over the 5-year survey period.⁸ Finally, the increased affiliation between academic medical centers and colleges of pharmacy and the introduction of the concept of layered learning have likely contributed to an increase in the expectations of PGY-1 residents participating in the precepting of pharmacy students.⁹

In addition to program design, we found a significant increase (25%) in the number of PGY-1 pharmacy resident positions

being offered. This finding was not surprising and mirrors data revealed by the ASHP Match Statistics. These data show an increase from 2268 to 3309 applicants matched to PGY-1 positions from 2012 to 2016, a 46% increase over 4 years.¹⁰

The survey revealed that the number of PGY-1 pharmacy residents going on to PGY-2 or fellowship has increased significantly over the 5-year survey period, while the number of PGY-1 pharmacy residents going directly into hospital-based positions in the year after PGY-1 pharmacy residency has decreased. A 2010 survey of ASHP member pharmacists found that of pharmacists who completed postgraduate training, 53%

Figure 3. Survey of residency programs indicating median percentage of residents going on to PGY-2 or fellowship training: 2011-2012 residency academic year vs 2016-2017 residency academic year.

Note. The error bars in Figure 3 represent the interquartile range.

Figure 4. Survey of residency Programs indicating percentage of residents going on to a hospital-based position in the year following PGY-1: 2011-2012 residency academic year vs 2016-2017 residency academic year.

Note. The error bars in Figure 4 represent the interquartile range.

worked in a hospital-based position.¹¹ A recent publication by Bishop and colleagues also reported a high percentage of PGY-1 pharmacy residents pursuing hospital-based positions as clinical staff pharmacists.⁴ These data are consistent with our findings at the beginning of the 5-year survey period which demonstrate a median of 50% of pharmacists completing PGY-1 pharmacy residency worked in a hospital-based position. According to the ASHP Match Statistics, the percentage of PGY-1 pharmacy residents matched to a PGY-2 pharmacy residency position in the following year has increased from

26% to 34% from 2012 to 2016, respectively.¹⁰ This increase is consistent with our data which demonstrate a 20% increase in PGY-1 pharmacy residents that pursue PGY-2 pharmacy residency over the 5-year survey period. This increased pursuit of and placement into PGY-2 pharmacy residencies will result in an increased number of specialized clinical pharmacists. This change could suggest a trend toward increased specialization in clinical pharmacy practice. However, this change may also reflect that there have been changes in the available job opportunities for PGY-1 pharmacy residency graduates.

Regarding current hiring requirements at academic medical centers, 29% of responders to our survey now require a minimum of PGY-1 pharmacy residency as a minimum qualification for a hospital staff pharmacist. Historically, no pharmacy residency training was required for a hospital staff pharmacist position. With the increase in the number of PGY-1 pharmacy residents graduating, we hypothesize that this 29% will continue to increase.

Our data reaffirm currently available ASHP match data that show continued growth in PGY-1 and PGY-2 residency program participation. Despite this redundancy, our survey provides unique and meaningful data about possible changes occurring with program design. Notably, designs continue to be highly variable between programs. While numerous changes to individual program designs were evident from our survey data, an increased emphasis on teaching experience was the only unifying change found across programs.

Limitations are inherent with a survey, and asking questions with percentage responses does lend some bias in this study. Our incomplete response rate, at 45%, can be considered a potential limitation. However, current survey literature similar in design to our survey also suggests a response rate between 30% and 60%.¹²⁻¹⁵ Evaluating changes over the 5-year survey period may have been a limitation as some programs may have implemented major changes earlier than 5 years ago. Other limitations that come with a survey are the potential for misinterpretation of survey questions and recall bias when filling out the survey.

Conclusion

Substantial variation between PGY-1 pharmacy residency program designs exists at academic medical centers. Though numerous design changes are occurring among individual programs, an increased emphasis on training in the area of teaching is evidenced across programs. An increasing number of PGY-1 program graduates from academic medical centers are pursuing specialized training, which is congruent with a national expansion in PGY-2 training opportunities. This may suggest a shift toward increased specialization in clinical pharmacy practice or overall changes in career opportunities. The overall effect of these changes on current and future pharmacy practice deserves further analysis.

Appendix

Survey Questionnaire

Section 1: Describe PGY1 pharmacy residency program design among respondents

1. How many beds are there in your institution?
 - a. Less than 200
 - b. 200-299
 - c. 300-449
 - d. 450-599

- e. 600-799
- f. 800-999
- g. Greater than or equal to 1000

2. How long has your PGY1 Pharmacy Residency Program been ASHP Accredited?
 - a. Less than 1 year
 - b. 1-5 years
 - c. 6-10 years
 - d. 11-15 years
 - e. Greater than 15 years
 - f. Currently in pre-accreditation status
3. Over the next 5 years, what plans do you have to expand PGY1 or PGY2 Residency Program positions?
 - a. Increase PGY1 program positions
 - b. Increase PGY2 program positions
 - c. Increase positions for both PGY1 and PGY2 programs
 - d. No changes anticipated
4. Which learning experiences are REQUIRED for completion of your PGY1 residency program (please check all that apply)?
 - a. Administration
 - b. Ambulatory Care
 - c. Anticoagulation
 - d. Cardiology
 - e. Critical Care
 - f. Drug Information
 - g. Emergency Medicine
 - h. Endocrinology/Diabetes
 - i. Family Medicine
 - j. Geriatrics
 - k. HIV/AIDS
 - l. Infectious Disease
 - m. Internal Medicine/Adult Medicine
 - n. Medication Safety
 - o. Nuclear Medicine
 - p. Oncology
 - q. Orientation
 - r. Pediatrics
 - s. Pharmacy Informatics
 - t. Psychiatry
 - u. Transplant
 - v. Women's Health
 - w. Research
 - x. Pharmacy operations/pharmacy practice
 - y. Other (please specify)
5. Which learning experiences are elective experiences offered by your PGY1 residency program (please check all that apply)?
 - a. Administration
 - b. Ambulatory Care

- c. Anticoagulation
 - d. Cardiology
 - e. Critical Care
 - f. Drug Information
 - g. Emergency Medicine
 - h. Endocrinology/Diabetes
 - i. Family Medicine
 - j. Geriatrics
 - k. HIV/AIDS
 - l. Infectious Disease
 - m. Internal Medicine/Adult Medicine
 - n. Medication Safety
 - o. Nuclear Medicine
 - p. Oncology
 - q. Orientation
 - r. Pediatrics
 - s. Pharmacy Informatics
 - t. Psychiatry
 - u. Transplant
 - v. Women's Health
 - w. Research
 - x. Pharmacy operations/pharmacy practice
 - y. Other (please specify)
6. How many elective learning experiences do you offer to your residents in a residency year?
 7. Is an internal medicine/adult medicine learning experience at your program longitudinal (repeating/multiple experiences) or rotational (isolated learning experience)?
 - a. Rotational
 - b. Longitudinal
 - c. Not offered
 - d. Other (please specify)
 7. What percentage of a resident's year was spent in elective learning experiences in your program 5 years ago (2011-2012 residency year)?
 8. What percentage of a resident's year is spent in elective learning experiences in your program for the 2016-2017 residency year?
 9. What percentage of a resident's year was spent on teaching experiences (teaching certificate, didactic lectures, precepting students) in your program 5 years ago (2011-2012 residency year)?
 10. What percentage of a resident's year is spent on teaching experiences (teaching certificate, didactic lectures, precepting students) in your program for the 2016-2017 residency year?
 11. What percentage of a resident's year was spent on research (dedicated or longitudinal) in your program 5 years ago (2011-2012 residency year)?
 12. What percentage of a resident's year is spent on research (dedicated or longitudinal) in your program for the 2016-2017 residency year?
 13. On average over the last 5 years, what percentage of your residents' research projects are published in a peer-reviewed journal within a year of graduating from the residency?
 14. What changes do you plan to make to your program design within the next 3 years?
 - a. Increase internal medicine learning experiences
 - b. Decrease internal medicine learning experiences
 - c. Increase specialty/elective learning experiences
 - d. Decrease specialty/elective learning experiences
 - e. No changes anticipated
 - f. Other
 15. What barriers do you perceive to changes you would like to make to your program (please check all that apply)?
 - a. Financial barriers
 - b. Lack of time to dedicate to residents
 - c. Infrastructure/space
 - d. Other (please specify)

Section 2: Characterize key changes that residency programs have made over the past 5 years

1. How many PGY1 Pharmacy Resident positions did your program offer 5 years ago (2011-2012 residency year)?
2. How many PGY1 Pharmacy Resident positions did your program offer for the 2016-2017 residency year?
3. What percentage of a resident's year was spent on an internal medicine learning experience in your program 5 years ago (2011-2012 residency year)?
4. What percentage of a resident's year is spent on an internal medicine learning experience in your program for the 2016-2017 residency year?
5. What percentage of a resident's year was spent in a staffing (pharmacy operations/order validation/dispensing role) in your program 5 years ago (2011-2012 residency year)?
6. What percentage of a resident's year is spent in a staffing (pharmacy operations/order validation/dispensing role) in your program for the 2016-2017 residency year?

Section 3: Characterize future training and career path among PGY-1 pharmacy residents

1. Five years ago, what percentage of your graduating PGY-1 residents obtained a PGY2 residency or fellowship immediately after PGY-1 completion?
2. Of your PGY-1 residents that graduated in 2016, what percentage obtained a PGY2 residency or fellowship?
3. Five years ago (2011-2012 residency year), what percentage of your PGY-1 residents obtained a hospital-based position immediately after program completion?
4. Of your PGY-1 residents that graduated in 2016, what percentage obtained a hospital-based position immediately after program completion?
5. Five years ago (2011-2012 residency year), what percentage of your PGY-1 residents obtained an

ambulatory care position immediately after program completion?

6. Of your PGY-1 residents that graduated in 2016, what percentage obtained an ambulatory care position immediately after program completion?
7. Five years ago (2011-2012 residency year), what percentage of your PGY-1 residents obtained an academic faculty position immediately after program completion?
8. Of your PGY-1 residents that graduated in 2016, what percentage obtained an academic faculty position immediately after program completion?
9. Please respond with your opinion by rating on a 10-point scale to the following statement: I feel that my residency program adequately trains pharmacy residents to meet current pharmacy practice needs. 0-1-2-3-4-5-6-7-8-9-10 (0 strongly disagree, 5 neutral, 10 strongly agree)
10. What are your institution's qualification requirements for hiring a hospital pharmacist?
 - a. Minimum of PGY1 Pharmacy residency
 - b. Minimum of PGY2 Pharmacy Residency
 - c. PGY1 Pharmacy residency or a minimum of 3 years of hospital work experience
 - d. No hospital experience or residency training is required
 - e. None of the above

Acknowledgments

The authors would like to thank all of the residency program directors who responded to the survey.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

References

1. Murphy JE, Nappi JM, Bosso JA, et al. American College of Clinical Pharmacy's vision of the future: postgraduate pharmacy residency training as a prerequisite for direct patient care practice. *Pharmacotherapy*. 2006;26:722-733.
2. American Society of Health-System Pharmacists. ASHP policy positions 2009-2013 (with rationales): education and training. <https://www.ashp.org/-/media/assets/policy-guidelines/docs/browse-by-document-type-education-training.ashx>. Accessed April 2, 2017.
3. The consensus of the Pharmacy Practice Model Summit. *Am J Health Syst Pharm*. 2011;68:1148-1152.
4. Bishop BM, Silverster JA, Martin CY, Bush CG. National survey of pharmacy residents nearing completion of the 2014-15 residency year. *Am J Health Syst Pharm*. 2017;74:843-852.
5. McCarthy BC Jr, Weber LM. Update on factors motivating pharmacy students to pursue residency and fellowship training. *Am J Health Syst Pharm*. 2013;70(16):1397-1403.
6. Vizient. Networks for academic medical centers. <https://www.vizientinc.com/Our-networks/Networks-for-academic-medical-centers>. Accessed September 15, 2017.
7. Required and elective educational competency areas, goals, and objectives for the postgraduate year one (PGY1) pharmacy residency standard. American Society of Health-System Pharmacists. <http://www.ashp.org>. Accessed April 2, 2017.
8. Grabenstein JD. Trends in the numbers of US colleges of pharmacy and their graduates, 1900 to 2014. *Am J Pharm Educ*. 2016;80(2):25.
9. Loy BM, Yang S, Moss JM, Kemp DW, Brown JN. Application of the layered learning practice model in an academic medical center. *Hosp Pharm*. 2017;52(4):226-272.
10. National Matching Services. ASHP resident matching program statistics. <https://www.natmatch.com/ashprmp/stats.html>. Accessed May 5, 2017.
11. Padiyara RS, Komperda KE. Effect of postgraduate training on job and career satisfaction among health-system pharmacists. *Am J Health Syst Pharm*. 2010;67:1093-1100.
12. Jellinek-Cohen SP, Cohen V, Rab S, Likourezos A. Characteristics that define a successful pharmacy resident as perceived by residency programs. *Hosp Pharm*. 2015;50(10):876-883.
13. Ansani NT, Schober CE, Fedutes BA, Culley CM, Patel SM. Meeting the modified drug information requirements of ASHP-accredited pharmacy practice residency programs. *Am J Health Syst Pharm*. 2003;60(22):2329-2332.
14. Ellis JJ, McCreddie SR, Gregory M, Streetman DS. Effect of pharmacy practice residency training on residents' knowledge of and interest in clinical research. *Am J Health Syst Pharm*. 2007;64(19):2055-2063.
15. Naples JG, Rothrock-Christian T, Brown JN. Characteristics of Postgraduate Year 1 Pharmacy Residency Programs at Veterans Affairs Medical Centers. *J Pharm Pract*. 2015;28(4):425-429.