RESEARCH

Student Characteristics Associated with Successful Matching to a PGY1 Residency Program

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Objective. To identify predictors for postgraduate matching success.

Methods. In April 2014, a survey was distributed to students at five schools of pharmacy in the United States assessing organizational involvement, research and work experience, postgraduation plans, match status, and demographics.

Results. Five hundred seventy-seven students (82%) completed the survey. Applicants who matched had a higher median number of interview offers compared to those who did not match. Significantly more females than males applied for a residency program. Those who matched had a higher median pharmacy school grade point average (GPA) compared to those who did not. No differences were observed in the rates of matching when leadership positions, student organizational membership, or previous work experience were considered.

Conclusion. For pharmacy students in this study, number of applications and interviews, pharmacy school GPA, and female gender were associated with a higher likelihood of matching.

Keywords: residency, matching

INTRODUCTION

Vision statements from the American Society of Health-System Pharmacists (ASHP) and American College of Clinical Pharmacy (ACCP) suggest that all pharmacists who have direct patient care duties complete at least a postgraduate year 1 (PGY1)-residency by 2020.^{1,2} Because the increasing number of pharmacy students pursuing a residency are outpacing the number of positions available, securing a pharmacy residency is becoming more competitive. In 2014, National Matching Services, Inc., reported that 4142 individuals participated in the match in pursuit of PGY1 positions compared to 2092 individuals in 2008.^{3,4} The number of available PGY1 residency positions increased from 1769 to 2862 during the same time period.^{3,4} As indicated by these statistics, the growth and development of PGY1 programs is not keeping up with the demand.^{3,4}

Given the highly competitive nature of the residency application process, programs are available to help pharmacy students improve their residency applications. Residency preparation guides suggest ways for pharmacy students to stand out among their peers to increase their chances of securing a residency position. For example, becoming more involved in student organizations, completing research projects, and maintaining a pharmacy school grade point average (GPA) >3.3 are suggested as ways to increase the likelihood of securing interviews and successfully matching.⁵ Many colleges and schools of pharmacy provide mentoring, seminars, and online resources to help prepare students for the residency application process.⁶ At the Johns Hopkins Hospital, Ensor et al sought to streamline the approach to screening pharmacy residency applications.⁷ Factors found to be most strongly predictive of offering an interview were professional association involvement, presentations, practice experiences, publications, work experience, GPA, and certifications. Theoretically, all of these preparation strategies and recommendations can increase students' chances of obtaining interviews and matching. However,

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evidence supporting specific strategies that enhance the likelihood of matching, as well as information on which student characteristics are highly influential in the matching process for a PGY1 program, is lacking. We conducted an observational study to identify predictors for PGY1 matching success among fourth-year pharmacy students at five schools of pharmacy across the United States.

METHODS

A survey tool was developed by three pharmacy faculty members at one school of pharmacy, and its questions were pretested at one school of pharmacy in 2013 with feedback incorporated as appropriate.⁸ Survey questions were developed using published literature and author consensus. Questions were pilot-tested on one third-year and three fourth-year pharmacy students, and their feedback was used to modify the questionnaire. Survey questions were assessed for face validity by two faculty members.

The survey was divided into six sections: (1) student organizational involvement (membership and leadership positions); (2) research experience; (3) work experience (any experience or hospital pharmacy experience); (4) postgraduation plans (pursuit of a residency); (6) demographics (gender, age, prior degree(s), and GPA during pharmacy school). Those who indicated they had pursued a residency were asked to provide the number of applications submitted, interviews offered, and whether they matched successfully during the regular match or post-match scramble (ie, match status).

In April 2014, a paper survey was distributed to all pharmacy students completing their final professional year during mandatory campus visits at five schools of pharmacy in the United States. A heterogeneous sample was chosen that consisted of both public and private institutions as well as a mixture of schools with different geographical locations and class size. This study was determined to be exempt from full review by the Midwestern University Institutional Review Board; a letter of support was received from each participating institution.

Descriptive statistics were used for the overall response rates at each site and for all survey items. Inferential statistics were used for planned stratifications of respondents according to whether or not respondents applied for residency, were offered interviews to at least 50% of programs to which they applied (for those who applied), or successfully matched (for those who applied). As pharmacy school GPA has been previously identified as a variable of interest, an evaluation was undertaken to determine whether a difference existed in matching success between those students having a pharmacy school GPA >3.3 and those with a pharmacy school GPA <3.3.⁵ Chi-square and Fisher exact analyses were

performed where appropriate for nominal data. Student *t* tests or Wilcoxon rank sum tests were conducted where appropriate for continuous data. An a priori level of significance was set at $\alpha=0.05$ for all comparisons. Data analyses, except where otherwise specified, were performed using Intercooled Stata, v13.0 (Statacorp, College Station, TX).

RESULTS

Five hundred seventy-seven students completed the survey from the five pharmacy schools, for an overall response rate of 82%. Overall, respondent demographics did not significantly differ according to survey site. Of respondents reporting an age ($n=555$), the mean (SD) age was 27.6 (3.9) years. Of those respondents reporting gender ($n=564$), females comprised 64.2% ($n=362$). The median self-reported pharmacy school GPA was 3.5 [interquartile range (IQR) 3.2-3.7].

Four hundred twenty-six respondents (74%) reported having work experience ($n=577$). Of these, 134 (24%) reported having hospital work experience ($n=559$). Two hundred sixty-one respondents (45.5%) reported having research experience. Of those reporting research experience, 178 (68%) had poster presentations, 38 (14.5%) had platform presentations, and 70 (26.8%) had peer-reviewed publications.

Student responses regarding the number of residency applications submitted are shown in Table 1. Overall, 36.1% (214/577) students applied for residency programs. Students who applied for a residency were more likely to: be a member of a student organization in pharmacy school (96.2% vs 82.1%); have previous research experience (68.2% vs 31.9%); have previous hospital work experience (34.4% vs 17.6%); and have previous work experience (80.8% vs 69.7%; $p<0.01$ for all). Students who applied for residency also had a higher median (IQR) number of leadership positions [1 (0-3) vs 0 (0-1)] and higher median (IQR) pharmacy school GPA [3.6 (3.4-3.8) vs 3.5 (3.2-3.7)] than nonapplicants ($p<0.01$ for both). Females were also more likely to apply for a residency (69.6% vs 60.9%; $p=0.035$).

Student responses regarding the number of interviews offered are shown in Table 2. At least one interview was offered to 95.5% (204/214) of students who applied for a residency program. The proportion of students offered more than 50% of the interviews at the institutions where they applied did not significantly differ between survey centers ($p=0.34$). Applicants who were offered fewer than 50% of interviews at institutions where they applied had applied to a higher median (IQR) number of residency programs [12 (8-15) vs 9 (6-11); $p<0.01$] and were more likely to have a lower median (IQR) pharmacy

Table 1. Characteristics of Applicants vs Nonapplicants

Variable	Did Not Apply n=363	Applied n=214	p value
Member of student organization in pharmacy school (n, %)	298 (82.1)	205 (96.2)	<0.01
Total leadership positions (median, IQR)	0 (0-1)	1 (0-3)	<0.01
Research experience (n, %)	115 (31.9)	146 (68.2)	<0.01
Hospital work experience (n, %)	61 (17.6)	73 (34.4)	<0.01
Any work experience (n, %)	253 (69.7)	173 (80.8)	<0.01
Age (mean, SD)	27.8 (4.3)	27.3 (3.2)	0.14
Female gender (n, %)	213 (60.9)	149 (69.6)	0.035
Prior degree (n, %)	268 (76.6)	169 (79.3)	0.44
Pharmacy school GPA (median, IQR)	3.5 (3.2-3.7) n=325	3.6 (3.4-3.8) n=210	<0.01
Pharmacy school GPA >3.3 (n, %)	217 (66.8) n=325	182 (86.7) n=210	<0.01

IQR=interquartile range; GPA=grade point average

school GPA [3.5 (3.3-3.7) vs 3.7 (3.5-3.8); $p<0.01$). On the other hand, applicants who were offered >50% of interviews were more likely to match (83.9% vs 68.1%, $p=0.01$). Applicant gender, age, or work experience did not significantly influence the likelihood of being offered more than 50% of interviews (Table 2).

Student responses regarding match status are shown in Table 3. The overall match rate for this study was 77.7% (143/184; 30 students did not report their match status but applied to at least one program). Match rates did not differ significantly among survey centers ($p=0.58$) or based on private vs public pharmacy school ($p=0.71$). Applicants who matched submitted a higher median IQR number of residency applications [11 (8-14) vs 8 (4-13); $p=0.01$] and were offered a greater median IQR number of interviews compared to those who did not match [5 (4-7) vs 2 (1-4); $p<0.01$]. Females comprised a larger proportion of students who matched compared to the proportion who did not match (75.5% vs 56.1%; $p=0.02$). Students who matched had a higher median pharmacy

school GPA (3.7 vs 3.5; $p<0.035$). There were no significant differences observed in other self-reported variables including the number of leadership positions held, member status in any pharmacy school club, or previous work experience (Table 3).

DISCUSSION

Our results suggest higher numbers of applications submitted and interview offers, as well as being female and having higher pharmacy school GPA, are associated with an increased likelihood of matching among pharmacy students pursuing postgraduate training. Factors such as student organizational involvement, research experience, and work experience did not seem to influence the likelihood of a successful match. The lack of association between these factors and match status may be related to homogeneity among those who applied for residencies. In other words, most students who applied had organizational involvement (96%), research experience (68%), or work experience (74%). Although our

Table 2. Characteristics of Students Offered < 50% vs ≥50% of Interviews

Variable	<50% of Interviews n=85	≥50% of Interviews n=129	p value
Member of student organization in pharmacy school (n, %)	81 (96.4)	124 (96.1)	0.99
Total leadership positions (median, IQR)	1 (0-2)	1 (0-3)	0.25
Research experience (n, %)	54 (63.5)	92 (71.3)	0.23
Hospital work experience (n, %)	29 (34.9)	44 (34.1)	0.90
Any work experience (n, %)	66 (77.7)	107 (82.9)	0.34
Number of applications (median, IQR)	12 (8-15)	9 (6-11)	<0.01
Age (mean, SD)	27.7 (3.5)	27 (3)	0.14
Female (n, %)	59 (69.4)	90 (69.7)	0.96
Prior degree (n, %)	67 (79.8)	102 (79.1)	0.90
Pharmacy school GPA (median, IQR)	3.5 (3.3-3.7) n=82	3.7 (3.5-3.8) n=128	<0.01
Pharmacy school GPA >3.3 (n, %)	64 (78.1) n=82	118 (92.2) n=128	<0.01
Any match (n, %)	49 (68.1) n=72	94 (83.9) n=112	0.01

IQR=interquartile range; SD=standard deviation; GPA=grade point average

Table 3. Characteristics of Matched vs. Unmatched Students^a

Variable	Did Not Match n=41	Matched n=143	p value
Member of student organization in pharmacy school (n, %)	39 (95.1)	138 (96.5)	0.65
Total leadership positions (median, IQR)	1 (0-2)	1 (0-3)	0.13
Research experience (n, %)	25 (61)	98 (68.5)	0.37
Hospital work experience (n, %)	13 (32.5)	51 (35.7)	0.71
Any work experience (n, %)	32 (78.1)	117 (81.8)	0.59
Number of applications (median, IQR)	8 (4-13)	11 (8-14)	0.01
Number of interviews (median, IQR)	2 (1-4)	5 (4-7)	<0.01
Received greater than 50% of interviews (n, %)	18 (43.9)	94 (65.7)	0.01
Age (mean, SD)	27.7 (3.6)	27.1 (3.0)	0.28
Female gender (n, %)	23 (56.1)	108 (75.5)	0.02
Prior degree (n, %)	30 (73.2)	115 (80.4)	0.32
Pharmacy school GPA (median, IQR)	3.5 (3.4-3.7) n=40	3.7 (3.5-3.8) n=143	0.035
Pharmacy school GPA >3.3 (n, %)	35 (87.5) n=40	132 (92.3) n=143	0.35

^aThirty participants applied to at least one program but did not disclose their match status

IQR=interquartile range; SD=standard deviation; GPA=grade point average

survey was not designed to evaluate the impact of a pre-disposition to volunteerism on the likelihood of residency application, it would be interesting to know whether residency-bound students were more inclined to be involved in these types of programs to increase their chances of procuring a residency position.

Likewise, the observed lack of associations between extracurricular covariates and match status could also be related to differences in the criteria used to evaluate potential candidates in each individual residency program. Blake et al conducted a survey of PGY1 residency program directors (n=232) and found that approximately 85% included evidence of leadership and previous work experience as interview selection criteria.⁹ However, only about 6-7% of directors indicated that these were the most important selection criteria.⁹ Conversely, 29.3% and 35.3% of directors indicated that these two criteria, respectively, were not among the top five criteria they use to select residency candidates for interviews.⁹ Criteria such as extracurricular activities, advanced degrees, and research experience were reported as less important to PGY1 program directors.⁹ While 65.1% of PGY1 directors reported extracurricular activities as a selection criterion for their program, 57.3% reported that this criterion was not among the top five criteria used to select residency candidates for interviews. A multivariate analysis of factors that were significantly associated with invitation to interview at one residency program (Johns Hopkins Hospital) included professional association involvement, presentations, practices experiences, publications, pharmacy work experience, pharmacy school GPA, and skills and certifications.⁷ Although extracurricular activities did not have a direct association with matching, students should not be discouraged from participating in these activities as

they may learn valuable skills necessary for successful completion of a residency program.

In our study, a pharmacy school GPA >3.3 was not associated with a greater chance of matching; however, pharmacy school GPA differed between applicants and nonapplicants to pharmacy residency programs, as well as between those students being offered more than 50% of interviews and those who were not. These results should be interpreted with caution as both grading scales and the extent of grade inflation may differ among schools.¹⁰ Similarly, pharmacy school GPA was self-reported in this survey. From the residency program director perspective, pharmacy school GPA appears to be a highly regarded criterion for selecting candidates for interviews. Approximately 94% of PGY1 directors reported using pharmacy GPA as a selection criterion, and 13.4% indicated pharmacy GPA was the most important criterion assessed for selecting candidates for interviews.⁹ Future studies should attempt to clarify whether a higher pharmacy school GPA is associated with match status as a result of director preference or candidate aptitude.

Female gender was positively associated with a likelihood of matching in this survey. Of note, the population surveyed was 64.2% (362/564) female, and the percentage of females who applied to residency programs was 69.6% (149/214). The match rate among females was 108/143 (75.5%). Other studies have observed an inconsistent effect of gender (female) on the likelihood of matching to residency programs among nonpharmacy health care disciplines. Although de Oliveira et al found similar results with applicants pursuing an anesthesiology residency,¹¹ other medical disciplines – including ophthalmology,¹² otolaryngology-head and neck surgery,¹³ plastic surgery,¹⁴ pediatric surgery,¹⁵ and pediatric dental¹⁶

did not. It is unknown if this effect is tied to overall candidate aptitude or the desire to diversify residency programs. As the field of pharmacy has a larger percentage of females than males, this is not a likely explanation of the results.¹⁷ Keshishian also found gender-based differences.¹⁸ Regarding influences on students' selection of pharmacy as a major, female students were more likely than males to select "desire to help others" as a strong motivating factor to pursuing a pharmacy career.¹⁸ One explanation for the differences in gender in the current study is that this desire is more apparent in female applicants and may be valued by residency programs; however, this would need to be systematically evaluated.

Special considerations should be noted regarding the use of the variable "greater than 50% of interviews secured." This construct should not be misinterpreted by potential candidates as a way to enhance their chances of matching by inflating the number of programs to which they apply. Candidates should carefully select residency programs based on individual preferences and mutual benefit to the program and candidate. Also, this variable may be influenced by the quality of the program to which the candidate applies and how many applications each program receives. Also, there may be limits to the number of programs to which a candidate may apply based on socioeconomic factors as each additional application incurs a fee after the baseline four applications.

Limitations to this study must be considered. This was a multisite cross-sectional survey of subject-reported data and is subject to reporting error and bias. However, the sample population included pharmacy schools from three of the four US Census Bureau regions and consisted of public and private, as well as new and established schools. Also the sample population was similar to class of 2014 statistics regarding gender, pharmacy class size, and age of students.¹⁹⁻²¹ It is unknown how the reputation of the pharmacy school or the reputation of the residency program influenced the results of this study. However, it would be difficult to objectively assess the reputation of the pharmacy school by each residency program director and the reputation of the residency program by each candidate. In addition, GPA was self-reported in this study, and there was no incentive for students to inflate their GPA as the survey was anonymous and administered after the match results were complete. This study was unable to assess the importance of several factors such as the ability of willingness of students being able to relocate, number of applications each residency program received, or how well the candidate interviewed with each program. We also did not assess the strength or type of residency program to which students applied and matched. It is possible that

different types of programs valued different characteristics and these nuances were not captured. These areas should be considered for future study. Finally, some pharmacy schools do not use GPA, and it is unclear whether other factors have more of an influence on the match rate for students at these schools. These factors should also be further investigated.

CONCLUSION

Among students at five US schools of pharmacy applying to residency programs, number of residency applications and interviews, pharmacy school GPA, and female gender were associated with a higher likelihood of matching. Identification of these factors may help candidates strengthen their applications. However, these data are not meant to imply that candidates should artificially inflate the number of programs to which they apply. This information may also be important to mentors as they guide candidates through the residency application process. Future studies should consider assessing the influence of the reputation of pharmacy schools and residency programs on the likelihood of a candidate matching to a residency program.

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Appendix 1. Survey Instrument

ORGANIZATIONAL INVOLVEMENT

1. Were you a member of any pharmacy school-affiliated organizations or clubs during pharmacy school?
☐ Yes (Proceed to question 2)
☐ No (Proceed to question 4)
2. Please indicate your level of involvement in pharmacy and nonpharmacy organizations:
☐ less than 1 hour per week
☐ 1-2 hours per week
☐ 2-7 hours per week
☐ More than 7 hours per week
3. Please indicate how many leadership positions you held in each of your pharmacy school years. *(For the purposes of this survey, a leadership role is defined as: president, vice-president, treasurer, and secretary. Elect positions do not count as leadership for this survey.)*
 - A. P1 year: _____ leadership positions
 - B. P2 year: _____ leadership positions
 - C. P3 year: _____ leadership positions
 - D. P4 year: _____ leadership positions

RESEARCH EXPERIENCE

4. Have you ever had experience participating in research during pharmacy school or prepharmacy school?
 - ☐ Yes (Proceed to Question 5)
 - ☐ No (Proceed to Question 6)
5. Please indicate how many poster presentations, platform presentations, peer-reviewed publications, and/or newsletter articles you have completed as a result of this research.
 - A. Poster presentations: _____
 - B. Platform presentations: _____
 - C. Peer-reviewed publications: _____
 - D. Other publications (e.g., newsletters): _____

WORK EXPERIENCE

6. In the table below, please indicate your employment experience during pharmacy school and during summer, as well as the approximate number of hours per week worked.

Work Experience	Hours/Week (During School)	Hours/Week (During Summer)
Pharmacy: Chain		
Pharmacy: Hospital		
Pharmacy: Independent		
Pharmacy: Internship		
Pharmacy: Other _____		
Nonpharmacy: _____		
No work experience		

ROTATION EXPERIENCE

7. Please place a check mark in the column that corresponds to the block in which you completed the following practice experiences. Also, for the elective rotation, please describe the type of elective you selected.

Type of Rotation	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
Ambulatory Care								
Clinical Specialty								
Community								
General Medicine								
Hospital								
Elective Describe: _____								

POSTGRADUATION PLANS

8. What are your postgraduation plans?
- ☐ I have accepted a part-time or full-time pharmacy-related job (if selected, please go to question #16)
 - ☐ Pharmacy residency (if selected, please go to question #9)
 - ☐ Pharmacy fellowship (if selected, please go to question #9)
 - ☐ Additional education (What kind: _____; go to question 316)
 - ☐ Undecided/I am still looking (go to question #16)
 - ☐ Other: _____ (go to question #16)

Residencies/Fellowship

9. How many postgraduate programs (residencies, fellowships) did you apply to? ____
10. Please place a check mark in the column that denotes how many of your recommendation letters came from each of the following individuals:

	None	1	2	3	4+
Clinical preceptor					
Employer					
Faculty member (nonpreceptor)					
Other: _____ (please specify)					

11. How many postgraduate program interviews were you invited to? _____
12. If you participated in the PGY1 Residency Match, how many programs did you rank in the match? _____
13. If you participated in the PGY1 Residency Match, did you match on March 21, 2014?
- ☐ Yes (proceed to question #16)
 - ☐ No (proceed to question #14)
14. Were you able to find a position through the postmatching “scramble”?
- ☐ Yes
 - ☐ No (proceed to question #16)
 - ☐ I don't know yet (proceed to question #16)
 - ☐ Did not participate in the postmatching scramble (proceed to question #16)

15. Please indicate which type of postgraduate training program you matched to or were accepted to after the scramble:
- ☐ PGY1 residency
 - ☐ Non-traditional residency
 - ☐ Industry fellowship
 - ☐ Managed care fellowship
 - ☐ Other: _____

Demographics

16. Please indicate your gender
- ☐ Male
 - ☐ Female
17. Please indicate your age: ____ years
18. Did you have a degree prior to enrolling in pharmacy school
- ☐ Yes
 - Which degree? _____
 - ☐ No
19. Please indicate your approximate *pre*pharmacy cumulative GPA: _____
20. Please indicate your approximate pharmacy school cumulative GPA: _____

Thank you very much for your time and participation!