Pharmacy Education, 2019; 19 (1) 138 - 145

Examination of the admissions process and admissions outcomes of a college of pharmacy in the United States of America

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Abstract

Objective: This study examined the admissions process used for candidate selection in a Doctor of Pharmacy (Pharm.D.) programme in Texas, United States and evaluated the process's outcomes.

Methods: Two years of Pharm.D. admissions data (2015 and 2016) were used. Applicants were divided into three groups: (i) early decision (ED); (ii) auto selected for interview (auto-IV); and (iii) reviewed by committee prior to interview (to committee, RTC). These groups were compared based on their admission's characteristics, the final outcome of their application, and first-year performance.

Results: From the combined data, a total of 968 complete applications were examined, out of which 160 were ED, 449 were auto-IV, and 408 were RTC. Among ED and auto-IV applicants, 110 (68.8%) and 273 (60.8%) were offered admission, respectively. Among the RTC applicants, 91 (22.3%) were interviewed and 30 (7.4%) were offered admission. Out of 18 RTC applicants that completed a full year of pharmacy school, first-year Grade Point Average mean (SD) was 2.99 (0.38) compared to all other applicants, 3.25 (0.49).

Conclusion: The auto-interview selection criteria used by the admission committee serves as an efficient screening tool for selecting well-performing applicants. Committee review and evaluation time did not lead to efficient outcomes and could be reviewed for optimisation.

Keywords: *College Of Pharmacy, Admissions Process, Admissions Outcomes, Pharmacy Education, Pharmacy Admissions, Pharmacy School*

Introduction

In regards to the development and training of Doctor of Pharmacy (Pharm.D.) students during pharmacy school, a special committee on admissions was created by the American Association of Colleges of Pharmacy (AACP) to answer the question "Are we producing innovators and leaders, or change resisters and followers?" The committee published an 18 page white paper report in the American Journal of Pharmaceutical Education (Wall *et al*., 2015). The report examined and evaluated current admissions practices, compared them to those used in other health professions, and made recommendations on how pharmacy schools can holistically assess applicants' ability to become a confident practitioners and future leaders. As of July 2017, there were 138 fully accredited pharmacy schools, according to the AACP, compared to only 130 in June 2014 (AACP, 2017). Because of reduction in application pools in recent years, it is even more important that schools examine the efficiency of their admissions and recruitment procedures (Wall *et al*., 2015). Considering the growth and maturity of pharmacy schools on a national level, an important goal for a pharmacy school is to get the most out of its applicant pool. There has been a great deal of literature published regarding the optimisation of applicant interviews, aiming to determine which applicant characteristics predict pharmacy school success and what characteristics make a good Pharm.D. applicant (Allen & Bond, 2001; Meagher, Pan & Perez, 2011; Kelsch & Friesner, 2012; Allen & Diaz, 2013; Chisholm-Burns *et al*., 2014; Giuliano, Gortney & Binienda, 2016). However, there is very little information in the literature pertaining to the specific processes pharmacy admission committees go through when selecting Pharm.D. applicants and the efficiency of such committees.

To apply to a pharmacy school in the United States (US), applicants generally must apply through the Pharmacy College Application Service (Pharm-CAS).

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ISSN 1447-2701 online

These Pharm-CAS applications contain a large amount of information about each applicant, including detailed academic history, Pharmacy College Admission Test (PCAT) scores, Test of English as a Foreign Language (TOEFL) scores, letters of reference, detailed work and volunteer history, as well as other details about the applicant (Pharm-CAS, 2017a). A printed Pharm-CAS application may be 20 pages or longer. Each year a large amount of time is spent by Pharm.D. admission committees, evaluating applicants based on their academic excellence, interpersonal skills, and leadership qualities. Due to the large amount of information, reviewing each application for specific criteria and qualifications can create a large burden on the admission committee. In addition, the criteria used for these evaluations do not have a standardised reference point, and therefore each committee member may apply their own criteria for evaluation. To address these issues, a pharmacy school in Texas, US established the use of auto-interview criteria (which is listed under the methods section) to differentiate their top tier applicants. Applicants that meet the criteria are automatically invited to an interview (auto-IV). The remainder of the applicants are evaluated by an admissions committee that reviews each application individually (to committee, RC group). The goal of the committee is to choose the best students that do not meet the auto-IV criteria to be interviewed and progressively considered for admission. The college also participated in an early decision (ED) programme. ED is a programme in which applicants may apply to one college of pharmacy as their first choice and must enrol in that college if they were accepted (Pharm-CAS, 2017b). As a result of the admissions processes, there are three distinct groups of applicants classified by the committee processes (ED applicants, auto-IV, and RC). It is imperative to understand the differences among characteristics and performance of these groups to understand the efficiency of the admission process and the committee.

Objectives

The objective of the current study was to examine the differences in characteristics among different pools of candidates applying to the Pharm.D. program (namely ED applicants, auto-IV, and RC), and to evaluate the selection criteria and the outcomes (academic performance after enrolment) of the admissions process, within a college of pharmacy in Texas, US.

Methods

This study employed a retrospective cross-section design using the College of Pharmacy admissions data for the years 2015 and 2016, provided by the college of pharmacy's admissions department. The data included each applicant's full Pharm-CAS application and additional data, including ED status (yes/no), auto-IV status (yes/no), RC status (yes/no), interview invitation (yes/no), the applicant's interview score, offer of admission (yes/no), offer acceptance (yes/no), and enrolment (yes/no). In addition, data for the first-year performance (GPA) of applicants who enrolled into the programme were obtained. All data obtained were de-identified.

Admissions Process

For the 2015 and 2016 admissions cycles, the admission committee began the decision process by first evaluating applicants that applied for ED. ED applicants that were not invited to an interview were returned to regular pool of applicants or denied admission. ED applicants that were interviewed were then offered admission, returned to regular pool, or denied. Regular admission applicants i.e., the regular pool of applicants were divided into two groups: auto-IV or RC, based on a pre-set criteria such that those who met the criteria were automatically selected for the interview (auto-IV) and those who did not were reviewed by the committee for the interview selection (RC). Criteria for auto-IV selection were based on pre-set cut-off scores for the following variables: math and science (MS) Grade Point Average (GPA), overall pharmacy school prerequisite GPA, PCAT composite and individual subject scores, number of dropped/failed/withdrawn grades received, letter of reference overall scores, and unpaid community service hours. The applicants that were not automatically selected for interview were reviewed by the admission committee to determine if they would receive an interview or be denied. After interview, every applicant was reviewed, and the committee made a decision to offer or deny admission.

Analyses

Admissions data from the years 2015 and 2016 were combined and a flow diagram (Figure 1) was created to represent the admissions decision process based on different groups of applicants.

The separate groups of applicants were compared based on a variety of variables, derived from Pharm-CAS applications. Among all information collected in Pharm-CAS, only those variables which could be quantified were included in the analyses (Table I) and included age, gender, interview average score, letter of reference average score, having a bachelor's or higher degree, having at least one additional language competency, having at least one publication, having at least one certification, having a prior academic suspension, and having a prior academic disciplinary action, pharmacy school prerequisite GPA, pharmacy school prerequisite MS GPA, PCAT composite scores, and number of awards.

Three sets of analyses were conducted. Each analysis was a comparison of means and frequencies of Pharm-CAS variables (listed in Table I), as well as first-year

pharmacy school GPA for those that enrolled. For the first analysis, the comparison was among three groups, namely: 1) auto-IV; 2) RC; and 3) ED admissions. A notable distinction in this first analysis was that instead of comparing the ED group to auto-IV and RC, the ED group was broken into those who were offered early admission, and those who were returned to regular pool. This subset of ED applicants were referred to as applicants given early admission (EA). The remaining ED applicants were included in the auto-IV or RC groups, depending on their designation after returning to the regular pool. This distinction was made in order to obtain a clear picture of the final outcomes of the admissions process, in which the ED applicants that were denied early admission were subsequently added to TC or auto-IV group.

A second analysis was completed, using the same set of variables, comparing only applicants that eventually enrolled and completed a full year in the program. Two groups were compared: 1) the RC group; and 2) all others (EA and auto-IV groups combined). The rationale for this specific comparison was that time spent by the committee on the RC group should lead to better outcomes, such as first-year pharmacy GPA.

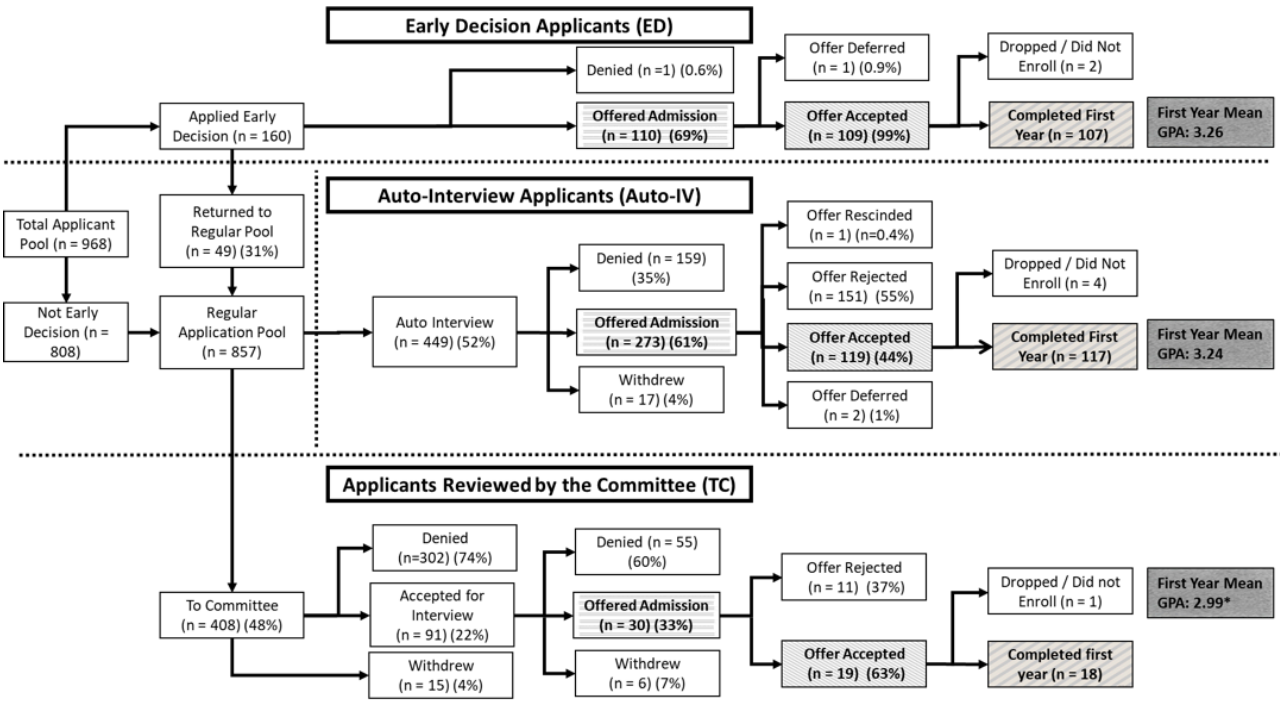
The third analysis, using the same set of variables, compared the full ED pool, including those applicants that were later returned to the regular pool, to all other applicants (RC and auto-IV combined). The specific goal of this analysis was to examine differences between the ED pool and regular pool.

Table I: List and Description of Pharm-CAS Variables Used in Analysis

Variable	Description
Age	Age of applicant
Gender	Gender of applicant
Interview Average Score	The average of the two average non-cognitive interview scores received at interview day
Letter of Reference Average Score	All letters of reference scores (1-4) received are combined to create an average score of (1-4)
Number of Awards	Total number of rewards the applicant reported in Pharm-CAS (For example, was on dean's list)
Has a Bachelors or Higher Degree	Highest degree reported by the candidate in their Pharm-CAS application
Additional Language Competency	A second fluent language listed by the candidate in their Pharm-CAS application
Has at Least One Publication	At least one publication listed by the candidate in their Pharm-CAS application
Has at Least One Certification	At least one certification (for example, pharmacy technician listed in Pharm-CAS)
Previous Academic Suspension	Reported in Pharm-CAS if the applicant has previously received any academic suspension
Previous Academic Disciplinary Action	Reported in Pharm-CAS if the applicant has previously received any academic disciplinary action
Pharmacy School Prerequisite GPA	Total GPA from courses which are considered to be prerequisites for Pharmacy School
Pharmacy School Prerequisite Math and Science GPA	Total GPA from math and science courses which are considered to be prerequisites for Pharmacy School
PCAT Composite Scores	Highest Reported Percentile PCAT Composite Score

Pharm-CAS=Pharmacy College Application Service; GPA=Grade Point Average; PCAT= Pharmacy College Admission Test

Figure 1: Flow chart for pharmacy school admissions decision process, using combined application data from years 2015 and 2016; A comparison of three groups (early decision applicants, auto-interview applicants, and applicants reviewed by the Committee prior to interview)



Data analysis was performed using SAS version 9.3 (SAS Institute Inc., Cary, NC). ANOVA was used to test for significance for continuous variables. Tukey's range test was used for direct comparison among the groups. *Chi*-square analyses were used to test for differences among categorical variables. A *p*-value of <0.05 indicated statistical significance. The project was approved by the institutional ethics review board under the exempt category.

Results

A total of 968 complete application records were obtained from combined years 2015 and 2016. Figure 1 displays a flow chart that represents the attrition of applicants within each group (early decision, auto-IV, and RC). Out of the 968 complete applications, 160 were ED applicants in which 110 (68.8%) were offered admission, 1 (0.6%) was denied, and 49(30.6%) were returned to the regular pool. Among the regular applicant pool (n=857), 449 (52%) met the criteria to be auto-IV. Of these 449, 273 (61%) were offered admission and 119 (26.5%) accepted the offer. The remainder of the regular pool, 408 (48%) were RC, in which 30 (7.4%) were offered admission and 19 (4.7%) accepted the admission offer.

Comparisons were conducted among auto-IV, RC, and EA applicants, by means (ANOVA) (Table II) and frequencies (*chi*-square) (Figure 2) for the Pharm-CAS variables. Direct comparisons among the groups were conducted for the continuous variables using the post-hoc Tukey's test. Comparing the auto-IV group to the RC group, prerequisite GPA, prerequisite MS GPA, PCAT composite score, number of awards, average interview score, and age had significantly different means ($p<0.05$). When the auto-IV group was compared to the EA group, only average interview score had a significantly different mean score ($p<0.05$). When the RC group was compared to the EA group, prerequisite GPA, prerequisite MS GPA, PCAT composite score, number of awards, and age, respectively had significantly different means ($p<0.05$)). Additionally, the categorical variables were directly compared among the groups using chi-square tests (Figure 2). For each possible comparison among the groups, the proportions that received an interview, received an offer, and accepted an offer were all significantly different ($p<0.05$). Additionally, for the auto-IV group compared to the RC group, the proportion of applicants that had a previous academic disciplinary action or had a previous academic suspension were significantly different ($p<0.05$). Then, for the auto-IV group compared to the EA group and RC group compared to the EA group, there was a significant difference when comparing the proportions of applicants that had a bachelor's degree or higher ($p<0.05$). Among these groups, 241 applicants enrolled and completed their first pharmacy year – 116 auto-IV applicants, 18 RC applicants, and 107 ED applicants. These groups' first pharmacy year GPA were (Mean (SD)): 3.24 (.53), 2.99 (.38), and 3.26 (.44), respectively. The differences were not statistically significant.

In the next analysis, RC students who enrolled in the programme were compared to the combined pool of students from the auto-IV and EA groups that enrolled (Table III). Variables that were found to be significantly different ($p<0.05$) were: first pharmacy year GPA, prerequisite GPA, prerequisite MS GPA, and, average interview score. Additionally, categorical variables were compared in this analysis (gender, having a bachelors or higher degree, having at least one additional language competency, having at least one publication, having at least one certification, having a prior academic suspension, and having a prior academic disciplinary action), and no comparisons were significantly different.

Table II: Comparison of characteristics of three applicant Groups: Auto-interview applicants (Auto-IV), applicants reviewed by the Committee (RC), and applicants that were offered early decision admission (EA), (combined years 2015 and 2016)

Variable	Auto-interview (n 449) M (SD)	Reviewed by the Committee (n 408) M (SD)	Early decision admission (n 110) M (SD)
Age[†,§]	22.35 (3.87)	23.58 (5.12)	22.17 (4.70)
Prerequisite GPA[†,§]	3.57 (0.27)	3.13 (0.40)	3.58 (0.27)
Prerequisite Math and Science GPA[†,§]	3.47 (0.38)	2.95 (0.50)	3.51 (0.35)
PCAT Composite Score[†,§]	84.62 (11.08)	60.33 (23.27)	84.88 (10.08)
Letter of Reference Average Score	3.89 (0.21)	3.85 (0.27)	3.89 (0.19)
Number of Awards[†,§]	3.63 (0.10)	2.55 (2.98)	4.036 (0.13)
Average Interview Score[†,¶,‖]	3.75 (0.66)	3.78 (0.64)	4.027 (0.46)

[†] Statistically significant difference between auto-IV and RC groups, *p*-value <0.05
[¶] Statistically significant difference between auto-IV and EA groups, *p*-value <0.05
[§] Statistically significant difference between RC and EA groups, *p*-value <0.05
[‖] Calculated for applicants that received an interview
Between-group comparisons were calculated using Tukey's post hoc test
GPA=Grade Point Average; PCAT= Pharmacy College Admission Test

Table III: Comparison of characteristics and outcomes among applicants who enrolled in the Pharm.D. programme: Applicants reviewed by the Committee prior to interview versus all other applicants†, (combined years 2015 and 2016)

Variable	Reviewed by the Committee (n 18) M (SD)	All others (n 223) M (SD)
Age	22.11 (2.11)	22.54 (4.55)
Prerequisite GPA*	3.30 (.33)	3.58(.26)
PCAT Composite*	80.28 (12.39)	84.68 (10.27)
First Pharmacy Year GPA*	2.99 (.38)	3.25 (.49)
Letter of Reference Average Score	3.91 (.19)	3.90 (.18)
Number of Awards	4.28 (4.07)	3.83 (3.02)
Average Interview Score*	4.27 (.32)	4.033 (.44)
Outcome: Prerequisite Math and Science GPA*	3.10 (.39)	3.48 (.42)

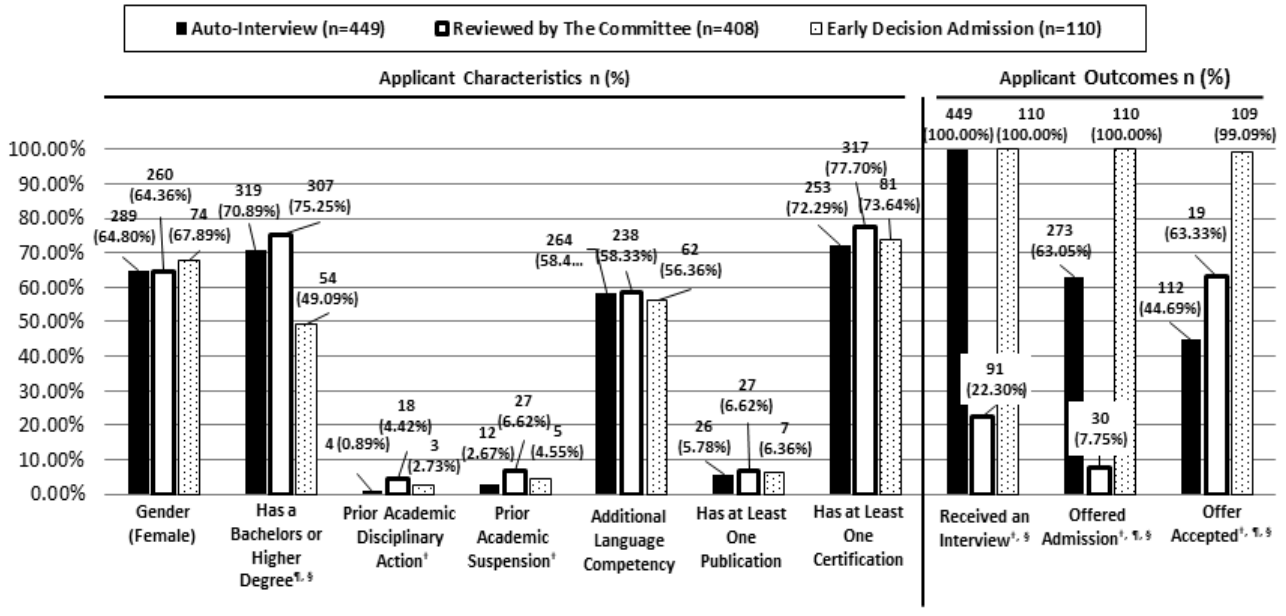
*Statistically significant differences, calculated by *t*-test, *p*-value <0.05
† "All other applicants" includes those who were offered early decision admission or met auto-interview criteria
GPA=Grade Point Average; PCAT= Pharmacy College Admission Test

Table IV: Comparison of means between regular admissions applicants and applicants that applied for early decision (ED), (combined years 2015 and 2016)

Variable	Regular Admission Applicants (n 808) M (SD)	Applied for Early Decision (n 160) M (SD)
Age	22.87 (4.40)	22.71 (5.34)
Prerequisite. GPA*	3.36 (.41)	3.52 (.31)
Prerequisite Math and Science GPA*	3.22 (.51)	3.44 (.39)
PCAT Composite*	73.55 (21.64)	69.24 (15.91)
Letter of Reference Average Score *	3.87 (.23)	3.87 (.24)
Number of Awards	3.16 (3.09)	3.53 (3.15)
Average Interview Score	3.78 (.65)	3.88 (.57)

*Statistically significant differences, calculated by *t*-test, *p*-value <0.05
GPA=Grade Point Average; PCAT= Pharmacy College Admission Test

Figure 2: Comparison of characteristics and outcomes of three applicant groups: Auto-interview applicants (auto-IV), applicants reviewed by the Committee (RC), and applicants that were offered early decision admission (EA), (combined years 2015 and 2016)



† Statistically significant difference between auto-IV and RC groups, *p*-value <0.05
¶ Statistically significant difference between auto-IV and EA groups, *p*-value <0.05
§ Statistically significant difference between RC and EA groups, *p*-value <0.05
Between-group comparisons were calculated using *chi* square test

A final analysis was conducted, comparing all applicants that applied for ED, compared to regular pool applicants, using *t*-test (Table IV). It was found that these groups significantly differed ($p<0.05$) by prerequisite GPA, prerequisite MS GPA, PCAT composite scores, letter of reference average score, and by the proportion that had a bachelors or higher degree. Additionally, categorical variables were compared in this analysis (gender, having a bachelor's or higher degree, having at least one additional language competency, having at least one publication, having at least one certification, having a prior academic suspension, and having a prior academic disciplinary action). One comparison was significantly different: 603 (74.63%) of non-early decision applicants received a bachelors or higher degree compared to 77 (48.12%) of early decision applicants that received a bachelors or higher degree ($p <0.001$).

Discussion

The admissions flow diagram illustrates notable differences in the attrition rates and outcomes among the ED, auto-IV, and RC groups, with comparatively fewer RC applicants eventually enrolling. This suggested that significant effort was spent by the committee to review applicants that eventually were either rejected or did not accept the offer. Overall the flow diagram suggests the most powerful indicators to offer admission was captured as part of the auto-interview criteria. Due to the results of the flow diagram, an admission process modification was implemented by the admission committee for the upcoming admission cycle (2018), changing the way the RC applicants are now reviewed.

Many of the significant differences among the groups were explained by the fact that the RC group was differentiated due to the auto-interview selection criteria. This resulted in the RC group having significantly lower prerequisite GPAs and lower PCAT composite scores. The RC group also differed significantly compared to the other two groups by number of awards listed on their Pharm-CAS application. One potential explanation for this was that it may be possible that a large number of awards may be GPA related such as dean's list (which is an award given based on a student's GPA). Future studies could investigate if awards listed on a Pharm-CAS application would correlate to pharmacy school success when adjusted for other factors. Another result was that the EA group had significantly higher interview scores compared to the other two groups. One explanation on this result may be that the EA group contains applicants who received an offer, while the other two groups in this comparison include students who were later rejected after the interview.

Interestingly, the students that were offered early admission were significantly less likely to have a bachelor's degree or higher, but maintained an equal or higher first-year GPA compared to the other two groups. This finding was contrary to a previous study published by McCall, Allen and Fike (2006). Their study indicated that having a bachelor of science degree was significantly associated with first-year pharmacy GPA (McCall, Allen, & Fike, 2006). An explanation for this discrepancy might be that in the previous two decades, there has been a transition towards pre-pharmacy programmes, which could prepare students for pharmacy school as well as or better than bachelor's degree programmes. Students that were offered admission had higher pre-requisite GPAs and PCAT scores while being less likely to have achieved a bachelor's degree, indicating that possession of a bachelor's degree may not be indicative of first-year pharmacy school success. The prevalence of pre-pharmacy programs may also explain the significant age difference in which the RC group was significantly younger compared to the other two applicant groups. Future studies could investigate if there may be a correlation between age and perquisite GPA or PCAT test scores.

Compared to all other applicants, the RC applicants that accepted an offer of admission had significantly lower scores for some variables (*e.g*., pre-requisite GPA, MS GPA). In addition, the RC applicants performed significantly worse in regard to their first-year pharmacy school GPA (2.99 versus 3.25). The difference in first-year pharmacy school GPA suggests the auto-interview criteria used by the committee effective at differentiating applicants that will do well academically in their first year. The significant difference in first-year pharmacy school GPA was not especially surprising because RC group included applicants that did not make the auto-interview cut-off, indicating lower pre-requisite GPA and PCAT scores. This finding correlates with reports from prior studies, which have demonstrated that lower pre-requisite GPA and PCAT scores were associated with lower first and second year pharmacy school academic success (Chisholm, Cobb & Kotzan, 1995; Meagher, Lin & Stellato, 2006; McCall, Allen & Fike, 2006; Meagher, Pan & Perez, 2011). In addition, other studies have also shown that prerequisite GPA and PCAT scores are significantly associated with the passing of the North American Pharmacist Licensure Examination (NAPLEX) (Allen & Diaz, 2013; Chisholm-Burns *et al*., 2014; McCall *et al.*, 2007). In contrast to the lower GPA and PCAT scores, the RC applicants that were admitted had significantly higher interview scores as compared to the auto-IV applicants. This suggests that certain other characteristics, that were not captured by GPA and PCAT scores and can be evaluated only via interviews, should be further evaluated to determine the influence on future academic performance. Another consideration regarding the RC applicants that were accepted was that they could be compared to a bottom portion of the auto-IV applicants rather than the entire pool because the auto-IV group may include many top tier students that the college of pharmacy will always wish to extend an offer. Additional future studies should examine how the RC group performs on other measures of success such as the NAPLEX exam.

Upon comparison of the ED group to all others, one interesting result is that the ED group had significantly higher prerequisite GPA but significantly lower PCAT composite scores. In addition, ED applicants were less likely to have a bachelor's or higher degree. However, despite these differences, the ED applicant group characteristics did not significantly differ in the area of interview score or first-year GPA suggesting that the ED group was at the least not inferior to the regular admission group. Given that ED applicants that were offered admission must accept the offer and that ED applicants had better performance scores, it may be beneficial in the future to offer admission to a greater number of ED applicants. Additional analyses could attempt to verify if applicants in the ED pool that were not selected still have better performance, or if there were a few exceptionally high performers in the ED pool that raised the averages significantly.

Limitations

One limiting factor of the current study was that the Pharm-CAS variables analysed only included variables that could be quantified into a continuous or categorical variable; for example, results from the Pharm.D. essays were not included. It is also not clear how these essays were used or evaluated by the committee. For the academic performance comparisons that were made, only first-year GPA was used as the dependent variable because the 2016 applicants had not yet completed their second year prior to the undertaking of this study. Additional data points such as second year GPA, and eventually NAPLEX scores may provide better performance evaluations in the future. Findings from the present study may not be generalisable to other colleges of pharmacy due to variations in admissions procedures, applicant pools and other geographical factors that may influence the admission decisions. None the less similar procedures used in the US or international colleges of pharmacy can use these results to help improve their admissions processes.

Future Studies

The study findings offer insights into the admissions process and could provide guidance for future evaluations. The performance of the applicants that were enrolled could be evaluated over all four years of the pharmacy programme and include NAPLEX scores to expand on the results of the current study. Additionally, data from more number of years could be pooled to obtain a larger sample size. A larger sample size would also allow additional sub-group analyses such as a closer examination of the ED group, which could be evaluated further by comparing the performance of those who were returned to the regular pool (after being denied for ED) versus those who applied via regular pool only. Such analysis could help determining if there is an innate value in offering admission to a student who has committed to the school by choosing that school for ED. Another important factor to examine could be the characteristics of those rejecting an offer to the college of pharmacy compared to those that accepted an offer, potentially offering insight into mechanisms to reduce the rejection rate.

Conclusion

The auto-interview selection criteria utilised by the Doctor of Pharmacy admission committee serves as an efficient screening tool for selecting applicants and should be continued. The committee review process for interview selection did not lead to efficient outcomes and could be reviewed for optimisation. The separate applicant groups had different rates of attrition, and the rejection rate of the auto-interview group was higher, indicating a possible area of focus for the admission committee. . The early decision applicants were shown to not be inferior to other applicants, and consideration may be taken to accept a larger number of these applicants.

Acknowledgments:

The authors declare no financial conflicts and no conflicts of interest.

The authors wish to acknowledge the contributions of the College of Pharmacy for making the data available, and the members of the College of Pharmacy's Admittance Committee and the office of admissions for providing feedback on understanding the processes.

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