

Predictors of Success Rate in the California State Board of Pharmacy Licensure Examination

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The purpose of this study was to determine performance predictors for the California State Board Examination (CSB exam). This information will provide quality assurance data to the Curriculum Committee at the University of Southern California School of Pharmacy. Graduates (N=166) from the 1998 Doctor of Pharmacy program were surveyed regarding their preparation for the examination, study habits, demographics, work experience, current position, and National Association of Boards of Pharmacy Licensure Examination (NABPLEX) results. Surveys were coded to track responses and to permit the inclusion of academic records in the factors analyzed. Success was defined as successfully passing the examination on the first attempt. One follow-up mailing was sent to nonresponders. A total of 113 graduates responded to the mail survey yielding a response rate of 68 percent. Of those responding to the survey, 112 reported having taken the June 1998 examination and 101 reported a passing score. Only 11 (9.8 percent) who responded did not pass. In the total cohort (N=166), individuals who passed the CSB exam had a significantly higher Pharmacy School grade point average (GPA), (3.28 ± 0.35) than those who failed (2.88 ± 0.32), $P < 0.05$. All students who reported taking the NABPLEX passed. Non-responders were significantly more likely to have failed the CSB examination. GPA in pharmacy school was identified as an important factor in predicting success on the examination.

INTRODUCTION

The California State Board Examination (CSB Exam) is designed to assess the competency of each candidate to practice pharmacy. The examination is based upon an analysis of pharmacist practice functions determined by the Competency Committee through a statewide survey of practicing pharmacists. A number of student factors may contribute to successful passage of the examination. In addition to student factors, pharmacy schools have modified their curriculum to meet the changing demands in the practice of pharmacy; the potential impact of these curricular changes has not been assessed. Contributing factors leading to the successful completion of the California State Board of Pharmacy Licensure Examination have not been reported in the literature.

A literature review produced few and somewhat conflicting reports regarding predictive performance factors in pharmacy state board examinations. Manasse *et al.*(1) investigated the relationship between academic performance and subsequent performance on the National Association of Boards of Pharmacy Licensure Examination (NABPLEX) in a small, private pharmacy school and a large, state-supported school. These investigators found a high correlation that existed between GPA and NABPLEX scores for candidates from the small, private school while low correlation was found on the GPA/NABPLEX relationship for candidates from the large, state-supported school. In another study that examined the degree of predictability of quantitative admission criteria on academic performance in a pharmacy school and on professional licensing examination, Lowenthal(2) reported no consistent predictors of performance. The impact of internship experience and student employment during the academic year to NABPLEX performance has also been evaluated. House and

Pevonka(3) concluded that there was no difference in board examination performance for students in a 1500-hour internship program completed prior to or partially after graduation. In addition, no difference was observed between the internship environment and performance on the board examination. Birdwell and Escovitz(4) study results indicated that there was no difference between the number of hours worked during the academic year nor the internship practice setting in regards to NABPLEX performance.

A review of the literature from other health professionals produced similar results. Younger(5) found the highest predictive value for passing the National Council Licensure Examination for Registered Nurses (NCLEX) was the student's grades in four core nursing courses. A second factor predicting positive NCLEX results was the Scholastic Aptitude Test (SAT) score. Grade point averages were reported to be valid predictors of NCLEX in some nursing students. Medical school applicant MCAT (Medical College Admissions Test) scores correlate positively with undergraduate GPA and undergraduate college attended(1). A study of medical students taking the NMBE Part I found a school sponsored review course improved the passing rate at Oklahoma College of Medicine(6).

The California State Board of Pharmacy reported an overall 50 percent passing rate for the June 1998 examination. The mean passing rate was 74 percent among the three California schools of pharmacy (University of California, San Francisco, University of the Pacific and University of Southern

¹Jones, R.E., "Effects in Performance of First Time MCAT Examinees Associated with Taking a commercial Coaching Course," Presentation, AERA, Chicago IL (April 1985).

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California). Western University did not have any examination candidates at the time of the study. California Board passing rates over the ten-year period from 1989 through 1998 for June examinations have ranged from 48.7 to 62.5 percent (mean 55.5 percent) for all candidates. California schools passing rates for the same period ranged from 72.4 to 83.9 percent (mean 78.9 percent). The passing score (student score) for the California examination varies with each examination and is determined by the Competency Committee.

In the Fall semester of 1996, the University of Southern California (USC) School of Pharmacy introduced a new pharmacy curriculum in keeping with evolving practices in the profession of pharmacy and health care reform. The School of Pharmacy endorsed the concept of "Pharmaceutical Care" defined as the provision of drug therapy for the purpose of achieving specific outcomes directed towards improving patient quality of life. The revised curriculum provided a significant increase in the use of small group discussions. Communication skill courses were moved earlier into the curriculum to better prepare students for early experiential education. Problem-based small group tutorials and discussions were added to the pharmaceuticals course. In the revised curriculum, there is a greater emphasis on problem solving and writing skills. The clinical sciences are introduced earlier in the curriculum to enhance the clinical relevance of basic science coursework. We undertook this study to serve as a baseline evaluation of the effect a curriculum change may have on board examination performance. In addition, we want to identify parameters to define risk factors for failing the California State Board of Pharmacy Licensure Examination for the purpose of intervention and student advisement.

METHODS

Study Design

The study was a self-report mail survey. All graduates from the Class of 1998 were sent a survey to their last known address requesting demographic information (present age, gender, marital status between Level I-IV); methods of preparation for the examination (*i.e.*, resource guides used for review and study habits); work experience, the number of years of pharmacy internship and the average number of hours worked as a pharmacy intern; and their academic performance, both pre-pharmacy and pharmacy. The graduates were asked if they had taken the CSB Exam and the NABPLEX, if they passed or failed the exam and for their examination scores. Return postage was included to improve response. Success was defined as passing the California Board of Pharmacy licensure examination at first attempt, in June 1998. The passing score and passing rate for the June 1998 examination were determined to be similar to passing rates and score of previous examinations from published results by the Competency Committee.

The surveys were number-coded in order to track responses and to include academic records of all eligible graduates. After we received the initial survey responses, a reminder notice was sent to nonresponders. Finally, nonresponders were sent a second survey requesting participation in the study. The licensure status of all nonresponders and a random selection of responders were verified with the California State Board of Pharmacy. The nonresponders not verified as registered pharmacists as of 1998 were considered unsuccessful at the California State Board of Pharmacy Licensure Examination. The randomly selected responders were verified

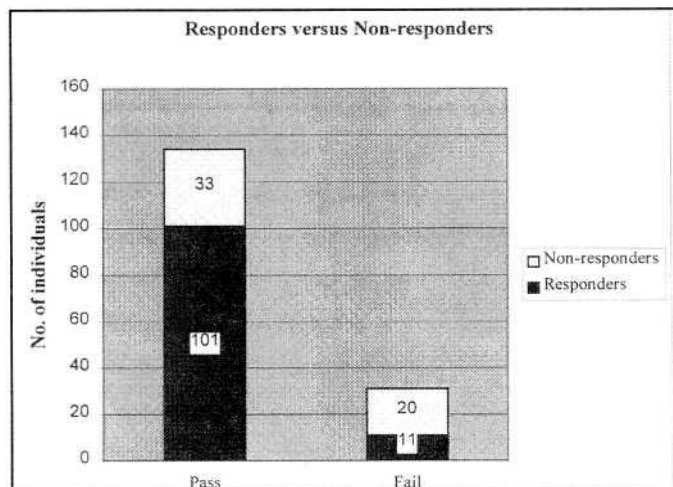


Fig. 1. University of Southern California's success rate in the California State Board of Pharmacy licensure examination in June 1998.

as a means of validating the self-reported information. Academic information such as GPA (pre and in pharmacy school), pre-pharmacy education and English language experience was derived from internal school records.

Study Population Analysis

All Doctor of Pharmacy graduates of the Class of 1998 from the University of Southern California School of Pharmacy were eligible for inclusion in the study. Students were included in the analysis if they reported taking the California Board Examination in June 1998 or if they did not respond to the survey. Students were excluded from the study if their graduation was delayed beyond the Spring of 1998 or if they did not take the CSB Exam in June.

Statistical Analysis

The student's *t*-test was performed to examine the relationship between academic performance in pharmacy school and pre-pharmacy GPA to the success rate in the California Board Examination. The significant level was set at $P < 0.05$. For comparisons using the amount of time that the graduates reviewed for the examination, we performed the analysis by determining the confidence interval (CI) set at 95 percent.

For nominal data, such as the relationship between community and hospital pharmacy internship experience and the success rate in the examination, we performed chi square analysis to determine the significance of this relationship.

RESULTS

A total of 166 individuals were identified for the study and mailed a survey. A total of 113, June 1998 graduates completed and returned the survey (68 percent). One hundred-twelve individuals of the 113 responders (99.1 percent) reported taking the California State Board of Pharmacy Licensure Examination in June 1998. The passing rate among responders was 90.2 percent ($n=101$) while the failing rate of the responders was 9.8 percent ($n=11$). Figure 1 shows the relationship of responders and nonresponders. Seventy-four of the 113 responders (65.5 percent) reported taking the NABPLEX, and all 74 candidates (100 percent) reported passing the examination.

A total of 165 graduates (99.4 percent) from the Class of 1998 were eligible for inclusion in the analysis of the study.

Table I. Results of total cohort (N=166)

Parameters	Results
Total No. graduates taking CSB examination	165
Total passing rate	134(81.2%)
Grade point average candidatesa	
Ave GPA of passing	3.28 ±0.35
Ave GPA of failing	2.88 ±0.32

^a*P* <0.05.

Based on the responders and verification with the California State Board of Pharmacy on the licensure status of the non-responders, there were a total of 134 graduates (81.2 percent) that passed the June 1998 CSB Exam on the first attempt (Table I). The average pharmacy school GPA for those who passed the examination was 3.28 ± 0.35 , while 2.88 ± 0.32 was the mean GPA for those who failed (*P* <0.05). In addition to evaluating GPA a sub-analysis was done to evaluate the relationship of a grade of C or lower in clerkship rotations to CSB Exam performance (Table II). The data demonstrates a trend correlating the increased number of C grades with increased risk of failing the CSB Exam. However, the sample size (33 students received C grades in clerkship) was not sufficient to reach significance.

Pre-pharmacy GPA was analyzed for correlation to CSB Exam performance. Pre-pharmacy GPA's were available for 164 graduates (99.3 percent) who took the examination. Of the 164 individuals, 138 (84.1 percent) passed the examination. For individuals who passed the CSB Exam, mean pre-pharmacy GPA was 3.39 ± 0.27 , which was not statistically different (*P* <0.08) from those who failed the examination (3.31 ± 0.23). The lack of correlation of pre-pharmacy GPA to passing the CSB exam may be due to the standards for admission to USC, since a GPA of 3.0 or higher is required for admission.

The California Board Examination is based upon pharmacist practice functions and is practice-based in format. An evaluation of a student's work experience was completed to assess the potential contribution of internship experience to examination results. Based on the response from the 112 returned surveys, the success rate was not dependent upon the length of time a student interned. The group that passed the examination interned 2.3 ± 1.2 years while the group that failed interned 2.6 ± 1.3 years. Statistical analysis between the two groups showed no significant difference.

Similarly, the average number of hours worked during the academic year was not significantly different between the two groups. When the numbers of hours per week were analyzed, no significant difference was seen in the group that passed versus those who failed. Data was also collected with regards to the type of internship experience obtained. Seventy-three individuals had prior community pharmacy experience, which included ambulatory care, chain, and independent community pharmacy while 54 individuals had experience in hospital pharmacy. Sixty-seven of the 73 graduates (91.8 percent) who interned in a community pharmacy, passed the examination on the first attempt, while 54 (87.1 percent) passed with hospital pharmacy experience. Twenty-nine of the 112 responders (25.9 percent) had both community and hospital pharmacy experience as an intern, with a passing rate of 90 percent. For this study, type of internship experience did not impact on successfully passing the Board Examination.

Additional analysis was performed to assess the impact of the amount of time spent reviewing for the examination on the

Table II. Impact of clerkship C's on California Board of Pharmacy licensure examination

No. Students with No C's	132
No. Passing	111/132 (84.1 percent)
No. Failing	21/132 (15.9 percent)
No. Students Receiving C's in Clerkships	33
No. Passing	23/33 (69.7 percent)
No. Failing	10/33 (30.3 percent)
No. Students Receiving > 2 C's	10
No. Passing	4/10 (40 percent)
No. Failing	6/10 (60 percent)

passing rate. According to the responses from the survey, the group that passed the examination reviewed a mean of 192 hours (95 percent confidence interval; 70-318 hours) and those who failed reviewed a mean of 240 hours (95 percent confidence interval; 100-353 hours). The total number of hours reviewed by the two groups did not differ significantly.

The potential impact of board review courses was also assessed. A student sponsored review course and a commercial course are both available to USC students. Fifteen of 18 graduates (83 percent) who reported attending the USC student course and 20 of 21 graduates (95 percent) who reporting attending the commercial course reported passing the CSB exam. The small number of students reporting attendance at review courses prevented results from achieving significance. The actual number of students participating in the students sponsored course was higher than the number reported above based upon the number of students counted at each session.

DISCUSSION

This study evaluated factors that may influence the success rate for candidates taking the California Board Examination for Pharmacists. Few published studies are available to identify factors that influence the success rate. The pharmacy profession is dynamic and evolving to meet the challenges in today's health care system. Pharmacy schools are modifying curriculum to meet these challenges. This study was done to establish a baseline for assessing curricular changes on CSB exam performance. It is reasonable to study the impact of curriculum changes on Board Exam passing efficiency to provide quality assurance for the academic institutions. In addition, it is unknown what the utility of these types of studies have on improving the quality of pharmaceutical education, because the published data to date are inconclusive. This analysis establishes a baseline to measure the impact of a new curriculum implementation.

Our study, which evaluated the graduates from the Class of 1998 at the University of Southern California School of Pharmacy, demonstrated that the academic performance in the pharmacy school is a strong predictor of the passing efficiency in the CSB Exam. Furthermore, the number of C's in clerkship courses may be a factor; however, the clerkship grades of C did not reach significance in this study. The may be due to the small sample size (n=33). Information from subsequent classes may clarify this issue.

Similar to other studies, this study found no correlation between pre-pharmacy academic performance and CSB Examination passing rates upon first attempt. One possible explanation for this finding is that the graduates come from different backgrounds in terms of their pre-pharmacy institutions and the number of years in pre-pharmacy school. One might expect that the methods of preparation, for pharmacy school,

by the different institutions to be different amongst each other and therefore serve as a confounding variable. The minimum GPA for admission at USC is 3.0 making the range narrow and differences difficult to detect.

Similar to other studies, the type of internship experience did not impact on passing efficiency. No other independent variable such as, number of years interned and the average number of hours worked were noted to impact the passing efficiency in the CSB Exam. Moreover, our data suggests that the type of internship, whether hospital or community pharmacy was not a good predictor of passing the Board Exam. The California Board of Pharmacy has a minimum requirement of 1000 internship hours to qualify for the licensure examination. This may partially explain the lack of influence that the number of intern hours had on passage rates since all examinees had a significant amount of intern experience. In addition, information regarding internship experience was available only for responders to the survey and only a small number of responders did not pass the examination making comparisons difficult.

CONCLUSION

This study describes the factors that influence the passing efficiency in the California Board of Pharmacy examination. The results of this study indicate that academic performance during pharmacy school is a major determinant on passing efficiency. Other factors including clerkship grades of C and intern experience did not reach significance. Additional studies that include other pharmacy schools in California are needed to validate this information.

We conducted this study because the University of Southern California recently revised its pharmacy curriculum and the information from this study will be used to provide quality assurance information to the Curriculum Committee. It will also serve as a baseline study for future projects.

The present study has certain limitations that must be considered in the context of research findings. First, based upon the survey response, our results indicate a bias toward respon-

ders who passed the CSB Exam after the first attempt (Figure 1). Individuals who passed the examination may be more willing to disclose personal information for the survey. Information from nonresponders was available only from academic records. A larger sample of students not passing the examination, especially regarding study and review practices and intern experience, may have allowed additional factors to reach statistical significance. Second, some of the information such as methods of preparation and internship experience are largely subjective and a high degree of variation was reported within each group. Knowing the results of the examination may also influence the subjective reporting of study hours for the exam. The self-report nature of some of the data is also a limitation of this study. Random verification of the self-reported passing scores did not yield any false responses but only a small number were verified. Finally, surveys might not have reached some individuals because of address changes. This could help explain the some of the nonresponses for this study. A proposal to minimize the study limitations in the future is to distribute the surveys prior to graduation and collect data before the examination results are reported.

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