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Variables Impacting Initial Drug Card Exam Pass Rates

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Table of Contents

Section Title **Page Number**

Key Words

Pharmacy Curriculum

Top 200 Drug Card Exams

NAPLEX

Abstract

Background and Purpose: Top 200 Drug Card Exams are administered in the professional program at South Dakota State University to prepare students for clinical rotations and board exams.

Methods and Materials: Analysis of several variables was performed to find their impact on initial drug card exam pass rates: first exposure to the exam content, hours spent studying for the exam, average hours worked in a week, and time worked in a pharmacy. Data for this study was collected through an optional survey provided to P1, P2, and P3 students and optional quizzes that were provided to both P1 (n=42) and P2 students (n=61).

Results: Using Fisher's exact test, the study found that there was statistical significance (p-value = 0.05) in pass rates between students who studied for the drug card exam for a total of 7.5 hours or more compared to those who spent less than 7.5 hours studying and in students studying more than two weeks before an exam to students who begin their studying less than two weeks before the exam. Additionally, statistical significance was found for P1 students who took one optional quiz for the second exam compared to those taking no quizzes; P2 students had statistical significance on the first exam of the semester in this analysis as well.

Conclusion: Results from this study demonstrate that providing optional or mandatory practice quizzes for students to prepare for these exams This research also provides objective data on strategies to increase the likelihood of passing Top 200 Drug Card exams.

Introduction

Professional students in the pharmacy program at South Dakota State University (SDSU) are required to take two drug card exams each semester during their first three years in the four-year program. These exams are referred to as the Top 200 Drug Card Exams; they cover a large variety of information that is provided in Table 1I about the 200 most prescribed medications throughout the United States. These exams are 35 to 50 questions in length and are designed to have 80% new material and 20% cumulative material previously on the exams. Note that a student's first Top 200 exam in their P1 year consists of only new material. Testable material for the exam is primarily all from *McGraw-Hill's Top 300 Pharmacy Drug Cards.*[1]

Information for drug card exams is not directly covered in any specific class; however, some components of the drug cards are taught during various lectures of pharmacotherapeutics, pharmacology, and pharmacy practice courses. While drug card exams generally create dissatisfaction among students, they are designed to improve a student's knowledge for a better experience during clinical rotations and prepare them for the NAPLEX pharmacy licensing exam. The curriculum committee believes these exams are beneficial for students because they are able to apply the tested information to different lecture topics, as well as effectively counsel patients at a pharmacy practice site during experiential activities.

These exams are unique when compared to others in the curriculum. This is because a student must achieve an 80% or higher on the 35-50 question exam to earn a passing grade. If a student does not achieve the 80% mark, they are required to retake the exam. If a student does not pass the exam on the second attempt, they are required to do a project before retaking the exam for a third time. The project's purpose is to aid students in having a different approach towards learning the material, thus increasing their knowledge of that exam's material. The exact format of the project is at the professor's discretion, but previous examples include presentations, study guides, and practice exams. If a student passes the exam on the second attempt, the two scores are averaged together to determine the final score with 80% being the maximum grade. If a student must retake the exam a third time, the highest score they can receive is 70%, and a 10% reduction in the maximum score is continued for each

attempt that the student needs. This final score cap serves the purpose of rewarding students who pass the exam on the first attempt. The only other exam that is similar to this structure in the curriculum is a calculations practicum, which is a review of calculation question problems that are similar to those seen on the NAPLEX.

Research on this topic was initiated to determine successful study habits and other parameters that lead to success for professional pharmacy students on the drug card exams. Statistics were collected and analyzed individually, as well as compared to the previous study titled, *The Techniques of Studying and Other Variables Impact on Initial Drug Card Exam Pass Rate*s.[2] This study was performed to increase the sample size of the students surveyed and to find variables overlooked in the previous study. One change in this study was providing P2 students with optional quizzes to establish that the benefit of these quizzes applies to the entire curriculum and not solely the P1 class.

Students choose different methods and times to initiate studying. Some start studying for the exam the night before, days before, a week before, or not at all. With the ability to retake the exam, some students elect to not study or do a minimal amount of studying and prioritize other courses instead. The purpose of this study is to determine what variables, if any, impact drug card exam scores and therefore retention of drug card exam material. Variables that were tested in this study include time spent working in a pharmacy, average hours of work per week, and the amount of time spent studying. Additionally, a follow-up analysis of the time a student begins studying was performed in this study, as there was a strong correlation between exam scores and the time a student begins studying in the previous study.[2] By looking at these and other variables, this study will help acknowledge what variables may not be beneficial and prepare future pharmacy students for these drug card exams

Literature Review and Project Framework

Prior to 2021, research had not been performed on this topic at SDSU. This initiated research in a study titled, *The Techniques of Studying and Other Variables Impact on Initial Drug Card Exam Pass Rates*. This study was able to show that students who were exposed to the material for the drug card exam more than two weeks before the exam date were more likely to pass on the first attempt than those who were exposed to the material less than two weeks before the exam. There was a statistically significant increase in P1 first-attempt pass rates when they attempted at least one optional weekly quiz before the exam compared to zero quizzes. With the opportunity to take optional weekly quizzes, students were encouraged to expose themselves to the material for the exam at an earlier date, as well as test their knowledge. While the previous study was able to find trends in an increase in pass rates for students that had work experience in a pharmacy, they were unable to reach statistical significance, so this current study was designed to determine if there is a correlation between hours worked in a pharmacy and passing rates on drug card exams.

Methods and Data Analysis

A few terms that need to be understood in this study include exposure, defined as the time between a student first studying for an exam and when the exam is administered. A community pharmacy is a locally accessible pharmacy for patients to collect their medications. Examples of these include Walgreens pharmacies or independently-owned pharmacies. The abbreviation “P1” stands for a first-year professional pharmacy school student with the number representing the year of the program they are currently in. Advanced Pharmacy Practice Experiences (APPEs) are rotations performed by fourth-year pharmacy students in order to be immersed in different pharmacy settings.

Two data sets were analyzed in this manuscript. The first was a case-control study via a survey. The second was a single-university cohort study that analyzed the completion of optional quizzes by P1 and P2 students.

The target population for this research is the professional students in the Pharm.D.

Program at South Dakota State University. An average of 63 to 67 students are enrolled in each of the classes (P1, P2, P3, and P4), leading to a small sample size. The 2022-2023 P1 cohort is smaller than the traditional average with a total of 42 students. The survey that data was collected from was administered via a QuestionPro survey, located in the supplemental material, sent to P1s, P2s, and P3s. It was available to students from November 14th, 2022 to November 30th, 2022. Additionally, data collected from the survey in *The Techniques of Studying and Other Variables Impact on Initial Drug Card Exam Pass Rates* was used to increase the sample size on some variables. Seventy-eight students completed the survey; the distribution of responses was 19 P1 students, 25 P2 students, and 34 P3 students. P4s were excluded from participating in the survey. The rationale for this decision is that the survey was sent out six months after this cohort's last drug card exam. This would have created difficulty in receiving accurate data from these students.

The survey consisted of 17 total questions, of which the majority of questions were multiple choice with a few fill-in-the-blank questions. This option was presented for students to provide additional information to some questions.

The data set from the optional quizzes conveyed the correlation between the number of optional quizzes attempted by P1 students with pass rates on the drug card exams. All P1 students (n=42) and P2 students (n=61) were given access to a series of optional quizzes of 10-16 multiple-choice, true or false, and matching questions. The quizzes were available through the Desire-to-Learn (D2L) class page of PHA 363L and 463L, better known as Pharmacy Skills Lab I and III which is the same class that their drug card exams are administered in.[3] The completion, or lack of completion, of these quizzes, did not provide any incentive or punishment for the students. The questions on the optional quizzes were created by a current P3 and current P2 and were designed to mimic questions on a drug card exam. The questions were not provided to the professors writing the exam due to their roles in writing the P1 and P2 students' drug card exams, nor were the exam questions provided to the students writing the optional quizzes. This was done to avoid any bias in the question-writing process of both parties. The quiz questions were proofread by P4 students, who were doing their academia APPE at the Brookings campus, to ensure questions were clear and answers were

correctly marked on the D2L page in order to minimize errors on the quizzes. There were a total of five optional quizzes leading up to the drug card exams for P1s. The P2s had 6 optional quizzes leading up to the first drug card exam and five for the second.

The quizzes were available one at a time (in the majority of cases) for one week at a time and would no longer be available to students after the announced deadline of the quiz. The next quiz would then be available to the students. This exception was made due to a shortened time frame between the P1s' first and the second exam. They only needed to complete one of the quizzes to receive credit for completing a quiz that week, however, all students who took a quiz attempted both quizzes that week. The scheduling of these quizzes was done for two reasons. The first was to prevent students from cramming all of the quizzes during the last day or week leading up to the exam and to encourage students to begin studying further out from the exam date.

These quizzes had questions that were related to a single (solely brand/generic questions) or a multitude of components of the drug card exam (column one of Table I). Additionally, after the first quiz, subsequent quizzes had review questions from any material that had already been assessed on previous quizzes. This was done to mimic the questions on the drug card exams. Each student was only given one attempt at a quiz and was then shown the questions answered incorrectly. The correct answer was never given to the student. The first quiz given to the students is provided in the supplemental material.

Measures taken to protect the identity of participants in this study, under the stipulation of the guidelines of the Institutional Review Board at South Dakota State University, included anonymous submissions of surveys and consent from participants to have their answers collected and analyzed. Additionally, data was received on completed optional quizzes and the pass/fail status of the student's two exams via de-identified data from the course coordinator. The analyzer was able to see which students (marked as Student 1, Student 2, …, Student 41) completed specific quizzes, how many quizzes, and what their pass/fail status was on their first attempt on the two examinations, but no information regarding the identity of the student was available to view.

The credibility of this study relied on the accuracy of the information within the

submitted surveys. All questions that were included in this study were analyzed before and after the collection of the data to ensure they were expressed clearly and had unbiased answers for participants to select from. Data analysis in this retrospective cohort study was performed using the statistical software, *Social Science Statistics*. Fisher's exact test was performed with a significance level of 0.05.

A calculation to find the average pass rate of students on their initial exam attempts was performed utilizing the survey data. This was calculated using the participants' responses to “How many drug card exams have you failed to pass on your first attempt?” From this, a percentage of passed drug cards was found by dividing the total number of drug card exams the participant had passed by the total number of drug cards attempted by that student. The total number of drug card exams was determined based on what class the student was in. P1s had taken two drug card exams, P2s had taken six, and P3’s had taken ten. Two students were calculated separately due to having to repeat a semester in pharmacy school and used information from other questions on the survey to calculate the pass rate appropriately. After finding the pass rate of all students, an average pass rate was calculated (68.9%). This average was used as the threshold for determining if a student was placed in the “passing student” group or the “failing student” group with those being higher than the average being in the “passing student” group and those below being placed in the “failing student” group.

Results

Exposure to studying for these drug card exams was analyzed by asking students how far in advance of the exam they typically study. Students were also asked in the survey that was analyzed in the previous study, but it failed to reach statistical significance. The analysis was repeated in this study and was done by adding the P1 students' answers to last year's responses.

Statistical significance was found that those who study two weeks or more before exams (87.9% pass rate) perform better than those that begin studying less than two weeks before the exam (56.4% pass rate) with a p-value of 0.0011. The analysis was run by adding the P1 responses from this survey to the survey data from the previous study, since the P1 students did not complete the survey in the previous study (n = 111). An analysis for using three weeks as a threshold was not able to be performed using Fisher's

exact test since there were no students that failed the exam if they studied more than 3 weeks in advance. Additionally, the one-week benchmark (72.37% for those greater than or equal to and 51.43% for those less than) did not find significance.

Time worked in a pharmacy and average time worked in a week were analyzed utilizing the survey data. Collection of this data involved the calculation of averages for each of the classes then a test was performed on students that worked longer and shorter than the average time. The thresholds tested were analyzed at 7.5, 10.5, and 12.5 hours with 10.5 hours being about the average across responses.

Those that were under the average time worked in a pharmacy had a 50% pass rate while those over had a 73.33% pass rate, but there was no statistical significance found ($p= 0.5431$). Additionally, the average number of hours a week with the benchmarks of 7.5, 10.5, and 12.5 hours did not display any statistical significance ($p= 0.4804$, $p= 0.3463$, and $p= >0.9999$).

The last analysis from the survey data was the average number of hours studied for each drug card exam. The average time studied was 14.42 hours per drug card exam. Statistical significance was found with those that studied more than 6.5 hours and 7.5 hours having a higher average drug card exam pass rate compared to those below the threshold ($p= 0.0424$ and $p= 0.0272$). The average pass rate was 63.93% for those who studied at least 6.5 hours and 33.33% for those below; the 7.5-hour average was 65.52% and 33.33%.

The quiz data was collected to be supplemental to findings in the previous study. This study repeated the P1 quizzes that were given in the past, but also provided quizzes to P2 students. Analysis was performed on each of the four exams to observe the difference in pass rate among those who took zero quizzes vs any number of quizzes, and those that took one or no quizzes vs two or more quizzes.

P1 students had statistical significance on the second exam of the semester for those who took no quizzes vs any quiz ($p =0.0009$). However, no statistical significance was found in those who took one or no quizzes vs two or more quizzes and either category on the first exam. P2 students had statistical significance on the first exam of the semester in both categories ($p =0.0356$ and $p =0.0335$), but not on the second exam. The average pass rate on the first exam for those that did not attempt a

quiz was 51.72%, and the average that did attempt at least one quiz was 78.13.

Discussion

When a student begins studying at least two weeks before the administration of a drug card exam, their likelihood of passing an exam is larger than those who begin their studying less than a week out. This data showed that there is an 87.9% pass rate for those who begin studying more than two weeks before the exam, while those who begin under two weeks have a pass rate of 56.41 %. Although statistical significance was not found for the likelihood of a difference in those who study more than three weeks out (100% pass rate, n=16) compared to those who are beginning their studying less than three weeks out (60% pass rate, n=95) due to the value being incompatible with the statistical test, there is a positive trend showing potential for statistical significance being found in future studies.

There was no significance found in a student that has worked in a pharmacy setting more or less than another student. There also was no statistically significant difference in pass rate on drug card exams when looking at the amount of time that students work in a week.

Statistical significance was found in an increase in pass rates of students that, on average, study 7.5 or more hours compared to those that study less than 7.5 hours. The same can be applied to the 6.5-hour benchmark. The pass rate difference was 63.93% for those who studied 6.5 hours or more and 33.33% for those below; the 7.5-hour average was 65.52% and 33.33%. Other values were tested (5.5, 8.5, and 9.5 hours) due to a strong correlation but were unable to reach statistical significance.

There was an increase in the likelihood of passing the first drug card exam for P2 students that attempted an optional quiz compared to those that did not attempt any quizzes. There was also statistical significance in the likelihood of passing the first drug card exam for P2 students for those who took one or no quizzes (56.82%) compared to those who took two or more quizzes (88.23%). However, the second exam for the P2 students did not reach significance in either category. The first exam for the P1 students did not reach

significance in either category, as well, but did have significance in the second exam for the increase of likelihood of passing in those who did any quizzes (84%) vs those who did not do any quizzes (29.41%).

Conclusion and Recommendation

One limitation of this study is that students that are highly motivated are likely going to pass the exam without the quizzes but take them anyway. We were not able to mandate participation in the quizzes. With a controlled experiment, this confounder can be eliminated. Survey data is also subjective and there is a possibility that recall bias was present in this study.

Additionally, the interpretation of the results in this study cannot be applied to other pharmacy programs, as the logistics and formulation of their "drug card exams" are different from those of South Dakota State University. For SDSU, the information can aid students in the future regarding how to prepare for drug card exams. For example, the study provided a threshold for the amount of time that a student should start studying before the drug card exam.

Data showed statistical significance in finding that the likelihood of passing an exam increases if you begin studying two or more weeks out compared to those who study less than two weeks out was confirmed in this study, confirming the result from the previous study.

It also disproved the theories of having more pharmacy work experience and less time working during the school year increases the likelihood of passing the exams.

The threshold for the amount of study time needed to increase your likelihood of passing was also found in this study. It showed that those who study for at least 7.5 hours have an increased chance of passing drug card exams compared to those who study less. The 6.5-hour mark also reached significance.

The information we gained from the quiz data set was very gray. For example, in the second drug card exam, the P2 students did not find statistical significance for those that decided to take the optional quizzes. Seven of the 61 students took two or more quizzes on the second exam. This was lower than other exams between the P1 and P2 classes. This made it difficult to have appropriately sized groups to analyze effectively and is another variable that could have benefitted from a controlled experiment. The first exam for the P2 students reached statistical

significance for those who took zero or one quiz compared to those who took two or more quizzes and for those who took any quiz versus no quizzes. The first part of the semester is called the "honeymoon phase" where there are not as many exams, providing more time and opportunity to study solely for drug card exams than later in the semester. However, there could be an argument that providing mandatory quizzes during this portion of the semester and the earlier part of the semester helps guide students to begin studying at an earlier date for these exams.

Similar to the proceeding study, we did not find statistical significance on the first drug card exam of the P1 students. Even if students are provided with quizzes to practice the material that will show up on the drug card exam, these P1 students have never had a drug card exam before. It's hard to get in the correct mentality and to have the right study habits to be successful on this exam. Statistical significance was not found on the P1's second exam for this study. However, looking at the previous study there was statistical significance. The conclusion for the lack of statistical significance in this study is likely due to the smaller sample size from this year's P1 class. The small sample size in both data sets and being an observational study are weaknesses of this study that can be improved by continuing the research on future cohorts.

Overall, the data shows that required quizzes can increase the likelihood of students passing these drug card exams and retain more information in order to succeed at the NAPLEX exam at the end of the curriculum. Based on information found from this study, students should be made aware of the time to benign studying and the amount of time that should be studied to increase their chances of passing. Presenting these endpoints to students or incorporating mandatory quizzes will lead to success on drug card exams, encourage stronger study habits for students, and improve retention of material.

Tables

Table I - Breakdown of Material covered on Drug Card Exams by Semester						
Topic	P1 Fall	P1 Spring	P2 Fall	P2 Spring	P3 Fall	P3 Spring
Generic and Trade Name	N	R & N	R	R	R	R
Controlled Substance Schedule	N	R & N	R	R	R	R
Therapeutic Class	N	R & N	R	R	R	R
Dosage Forms	N	R & N	R & N	R & N	R	R
FDA Indications	N	R & N	R & N	R & N	R	R
Adverse Effects	N	R & N	R & N	R & N	R & N	R & N
Patient Consultation	N	R & N	R & N	R & N	R & N	R & N
Dosages	X	X	R & N	R & N	R & N	R & N
Pharmacology/Pharmacokinetics	X	X	R & N	R & N	R & N	R & N
Drug Interactions	X	X	R & N	R & N	R & N	R & N

Contraindications, Precautions	X	X	R & N	R & N	R & N	R & N
N - New Material; R - Review Material; X - No Material						

Table II - Breakdown by Exposure Time			
Time of 1st exposure (n=111)	Pass (%)	Fail	Total
More than 3 weeks	16 (100.0)	0	16
2-3 weeks	13 (76.5)	4	17
More than 2 weeks	29 (87.9)	4	33
Less than 2 weeks	44 (56.4)	34	78
1-2 weeks	26 (60.5)	17	43
Less than 1 week	18 (51.4)	17	35

Table III - Breakdown of Pharmacy Setting

Time worked in a pharmacy setting (n=76)	Pass (%)	Fail	Total
Under the average	23 (50.0)	23	46
Over the average	22 (73.3)	8	30

Table IV - Breakdown of Hours Studied per Exam			
Average hours studied per exam (n=76)	Pass (%)	Fail	Total
≥9.5 hours	16 (33.3)	32	48
≥8.5 - <9.5 hours	1 (50.0)	1	2
≥7.5 - <8.5 hours	5 (62.5)	3	8
≥6.5 - <7.5 hours	1 (33.3)	2	3
< 6.5 hours	5 (33.3)	10	15

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Supplement