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Association between graduates' factors and success rate on the Saudi Pharmacist Licensure Examination: A single-Institution cross-sectional study

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ABSTRACT

Introduction: The Saudi Pharmacists Licensure Examination's (SPLE) initial results were revealed in February 2020, which showed enormous inconsistency with the passing rates. Hence, we aimed to investigate the predictors of pharmacy graduates' success rate on the SPLE of a single-college in Saudi Arabia. **Methods:** In a cross-sectional study of 2019-graduates, data were collected via-phone interviews and retrieved from the college's database. Graduates' data were retrieved from the college's database, which includes high school grade point average (GPA), General Aptitude Test, Scholastic Achievement Admission Test, preparatory year GPA, pharmacy GPA, and all courses' grades. The data collected via-phone interview includes information that was not recorded in the college's database, such as date of birth, SPLE score, and the number of SPLE attempts. We only included students who agreed to be interviewed and had attempted the SPLE at least once. We developed a prediction model using correlational analyses and stepwise multiple linear regression to examine graduates' factors in predicting success on the SPLE.

Results: Out of the 149 graduates, 105 fulfilled the inclusion criteria. Around 84% of them passed the SPLE. Correlation analyses showed a significant direct correlation between preparatory year GPA and pharmacy GPA with SPLE scores ($r = 0.228$, $P = 0.0193$ and $r = 0.533$, $P < 0.0001$, respectively). In addition, the results showed that all of the four SPLE content areas were positively correlated with SPLE scores ($P < 0.0001$). The stepwise multivariable regression showed that being a male graduate and scoring high-grade points in pharmacology and therapeutics courses were significantly associated with high SPLE scores ($P = 0.0053$, $P = 0.0256$, and $P = 0.0001$, respectively).

Conclusion: This single cross-sectional study found that being a male, pharmacology GPA, and therapeutics GPA were significantly associated with a higher SPLE score. Further studies should focus on the GPA cut off below which we should give remediation to improve SPLE passing rate.

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1. Introduction

Healthcare providers have been endowed with compassion and mercy, yet medical errors caused by negligence or due to lack of qualifications have always been a threat to patients' safety (Archer et al., 2016). Hence, the Saudi Commission for Health Specialties (SCFHS) has implemented stringent rules to assess and standardize the qualifications of healthcare providers, such as medical doctors, nurses, dentists, and pharmacists (SCFHS, 2020a). One of the rules established by SCFHS for new graduates

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or medical personnel expatriates is the obligation to sit for an exam, which assesses their true qualifications and knowledge of their particular field. Some examples include the Saudi Pharmacist Licensure Examination (SPLE), Saudi Medical Licensure Examination (SMLE), Saudi Dental Licensure Examination (SDLE), Saudi Nursing Licensure Exam (SNLE), and the Saudi Laboratory Licensure Examination (SLE) (SCFHS, 2020a).

SPLE is a validated and standardized exam established in January of 2019 by the SCFHS for newly graduated pharmacists, which is intended to measure the readiness of graduates to practice pharmacy (Chisholm-Burns, Spivey, Byrd, McDonough, & Phelps, 2017). Additionally, it is also useful in the assessment of ranking pharmacy programs across the nation (Chisholm-Burns, Spivey, McDonough, Phelps, & Byrd, 2014). The SPLE has now become mandated for all new pharmacy graduates in order to qualify them as capable of joining the workforce. SPLE consists of 300 multiple-choice questions (MCQs) which is intended to measure the knowledge in four major pharmacy content areas (Basic Biomedical, Pharmaceutical, Social/Behavioral/Administrative, and Clinical Sciences) (SCFHS, 2019). Graduates and interns are allowed four attempts annually for the SPLE; however, after passing, they have just one attempt per year in order to improve their scores (SCFHS, 2019). Examinees have to score 536 out of 800 to pass the SPLE, which is equivalent to a raw score of 56% (SCFHS, 2019).

There are 28 colleges of pharmacy in Saudi Arabia which have already started to include preparation courses for their “soon-to-be” graduates in order to assist them with their SPLE (K. K. University, 2019; P. N. University, 2019). Unfortunately, the first SPLE batch of results was announced in early 2020 and showed enormous inconsistency with the passing rates among these different colleges (SCFHS, 2020b). It is worth mentioning that few of these colleges provide more than one pharmacy academic program track, PharmD, and/or BPharm-track. PharmD track is a 6-years program that focuses on Therapeutics, Pharmacology and Hospital pharmacy and entail a one-year internship, on the other hand BPharm is a 5-year program which focuses more on pharmaceutical sciences (Ahmed & Ahmad Hassali, 2008). Moreover, the top pharmacy college whose graduates had the highest SPLE rates was also, incidentally, one of the most recently accredited colleges (Pharmacists, 2019). Such variability and irregularity have driven us to investigate the numerous factors which may, in fact, predict success on the SPLE.

Due to the scarcity of studies that investigates predictors of pharmacy graduates' performance in the SPLE in Saudi Arabia, we have searched for previously published experiences pertaining to similar examinations conducted in other countries, which also measured candidates' knowledge of pharmacy practice. We found multiple studies that were conducted using the North American Pharmacist Licensure Examination (NAPLEX) (Allen & Diaz Jr, 2013; McCall, MacLaughlin, Fike, & Ruiz, 2007). These studies found that pharmacy and pre-pharmacy grade point average (GPA), composite Pharmacy College Admission Test (PCAT) score, California Critical Thinking Skills Test (CCTST), and having no D or F scores, were all factors which correlated significantly with the NAPLEX passing rate (Allen & Diaz Jr, 2013; McCall et al., 2007). On the other hand, an inverse association was found between the test-takers' age and the NAPLEX passing rate (McCall et al., 2007). Because of significant differences between American pharmacy graduates, versus the Saudi ones, together with difficulty in extrapolating their research conclusions compared to the Saudi graduates' population, we decided to investigate factors related to Saudi pharmacy graduates from Umm Al-Qura University college of pharmacy such as high school grade point average (GPA), General Aptitude Test (GAT), Scholastic Achievement Admission Test (Science) (SAATS) Score, preparatory year

GPA, pharmacy GPA, and all courses grades, in order to more precisely predict success on the SPLE.

2. Methods

We conducted a cross-sectional study of graduates from Umm Al-Qura University, Makkah, Saudi Arabia. We included graduates of May 2019 who voluntarily agreed and consented to participate in a survey administered via an unstructured phone-interview and have taken the SPLE at least once. The survey administered via phone-interview contained questions that were intended to collect data that were not recorded in the college's database, such as the year of admission to Umm Al-Qura University College of Pharmacy, date of birth, date of SPLE attempt, number of attempts, as well as noting the highest SPLE grades they had scored. We used unstructured interviews to increase the response rate and to assure the accuracy of responses (Ziegenfuss, Burmeister, Harris, Holubar, & Beebe, 2012). Data were also collected from the college's database, which included the following: high school GPA, GAT, SAATS Score, preparatory year GPA, pharmacy GPA, and all relevant courses grade points. Data were then combined into an excel sheet.

Descriptive statistics (i.e., means and frequencies) were generated to summarize responses.

Student *t*-test was applied to explore the difference in GPA between graduates of Bpharm and PharmD programs. Wilcoxon rank-sum test was used to assess those who had passed and those who had not. Further, We developed prediction models using correlation analyses and multivariable linear regression to examine these graduates' factors in predicting success on the SPLE. Dummy variables were created for all categorical (ordinal) data. All Courses grade points that are relevant to the SPLE were included in our analyses. We grouped similar courses and estimated GPA by SPLE content areas (biomedical sciences, pharmaceutical sciences, clinical sciences, and administrative sciences) and extensively taught subjects in both programs (pharmaceutics, medicinal chemistry, pharmacology, and therapeutics). All analyses were performed using IBM SPSS Statistics, version 20 (IBM Corp., Armonk, N.Y., USA).

3. Results

Out of 149 graduates (class of 2019) who had been identified through the college database, 120 (80%) agreed to participate in a phone interview, of which only 105 (88%) stated that they had taken the SPLE at least once. Their first attempt was between April and December 2019. Fig. 1 describes the characteristics of all graduates who were included. All of the interviewed graduates had been admitted to the college between 2012 and 2016. About 52% of the graduates included were female with a mean age of 24 ± 1 years old. Around 89 of these participating graduates (84%) had actually passed the SPLE and 16 had failed, whereby the mean SPLE score was $62.3 \pm 10\%$. Around 82% of the participating graduates reported passing the SPLE on their first attempt. Around 55 of the participants (52.4%) graduated from the PharmD track with a mean GPA of 3.5 ± 0.2 out of a possible 4, while the other 50 graduated from the BPharm track with a mean GPA of 2.88 ± 0.4 out of 4. Student *t*-test results showed a significant difference in the mean GPA between PharmD versus BPharm graduates ($P < 0.0001$).

Table 1 shows the difference in mean between those who had passed the SPLE and those who had not in terms of pre-pharmacy and pharmacy achievement scores. The results showed a statistically significant difference between graduates who passed the SPLE compared to those who did not pass in terms of preparatory year GPA and Pharmacy GPA ($P = 0.0107$, $P < 0.0001$, respectively).

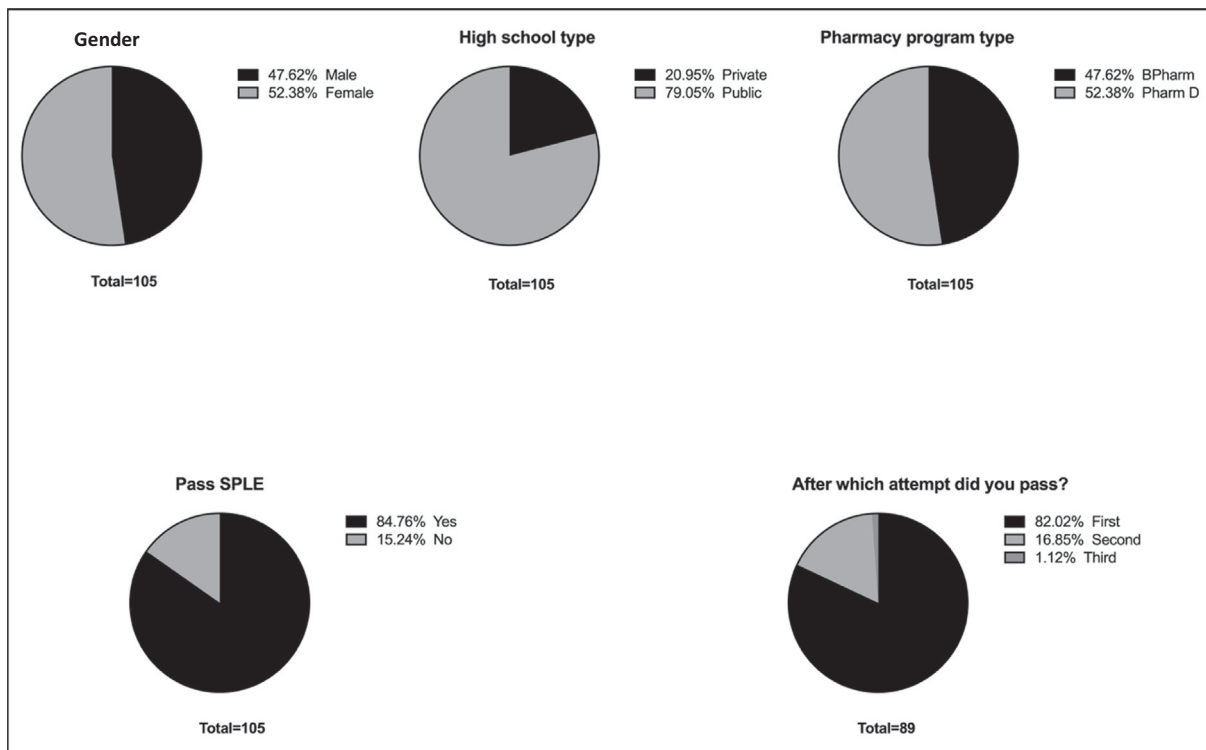


Fig. 1. Graduates characteristics. Abbreviations: SPLE, Saudi Pharmacist Licensure Examination.

Table 1
Pre-pharmacy and Pharmacy achievement scores.

P	Passing SPLE		Variables
	No (n = 16) M ± SD	Yes (n = 89) M ± SD	
0.7354	97.58 ± 1.7	97.58 ± 2.0	High School GPA out of 100%*
0.5475	79.69 ± 4.6	78.88 ± 5.2	General Aptitude Test score out of 100%
0.6367	74.37 ± 7.17	75.16 ± 5.7	Scholastic Achievement Admission out of 100%
0.0107	3.14 ± 0.2	3.34 ± 0.3	GPA first Year out of 4
< 0.0001	2.77 ± 0.4	3.29 ± 0.4	Pharmacy GPA out of 4

Abbreviations: SD, Stander Deviation; GPA, Grade Point Average.

Correlation analyses showed that the preparatory year GPA and Pharmacy GPA had a significant direct correlation with SPLE scores ($r = 0.228$, $P = 0.0193$ and $r = 0.533$, $P < 0.0001$, respectively) while SAATs, GAT, and high school GPA had no correlation (Table 2). When all independent variables were entered into the regression model 1, it was noted that only being a male ($\beta = 5.03$, $P = 0.0031$) and pharmaceutical sciences ($\beta = 10.13$, $P < 0.0001$) showed significant predictive values for SPLE scores. (Table 3) Further, when we added the most extensively taught subjects in the pharmacy program into the regression (Table 3, model 2), the results showed that being a male ($\beta = 4.48$, $P = 0.0053$), therapeutics GPA ($\beta = 4.06$, $P = 0.0256$), and pharmacology GPA ($\beta = 7.34$, $P = 0.0001$) were significantly predictors for SPLE score.

4. Discussion

To the best of our knowledge, this is the first study involving the investigation of pharmacy graduates' factors which may predict success on the SPLE in Saudi Arabia. We found a positive association between being a male, pharmacology, therapeutics

Table 2
Correlation between variables and SPLE score.

P	Coefficient	Factors.
Pre-pharmacy and pharmacy factors		
0.9726	0.01	High school GPA
0.9726	0.01	GAT
0.8419	0.02	SAATS Score
0.0193	0.23	Preparatory year GPA
< 0.0001	0.53	Pharmacy GPA
SPLE contents area		
< 0.0001	0.47	Biomedical Sciences
< 0.0001	0.58	Pharmaceutical Sciences
< 0.0001	0.55	Clinical Sciences
< 0.0001	0.51	Administrative Sciences
Pharmacy courses		
< 0.0001	0.52	Pharmaceutics
< 0.0001	0.57	Medicinal Chemistry
< 0.0001	0.60	Pharmacology
< 0.0001	0.56	Therapeutics

Abbreviations: GAT, General Aptitude Test; GPA, Grade Point Average; SAATS, Scholastic Achievement Admission Test (Science); SPLE, Saudi Pharmacist Licensure Examination.

Table 3
Results of stepwise multivariable linear regression model of variables on SPLE scores.

Variables	Coefficients	P
Model 1		
Gender (male)	5.03	0.0031
Pharmaceutical Sciences	10.13	< 0.0001
$R^2 = 0.40$, $F_{(2, 100)} = 32.76$, $P\text{-value} < 0.0001$		
Model 2		
Gender (male)	4.48	0.0053
Therapeutic	4.06	0.0256
Pharmacology	7.34	0.0001
$R^2 = 0.44$, $F_{(3, 99)} = 26.27$, $P\text{-value} < 0.0001$		

courses' grades, and a higher score on the SPLE. On the other hand, we did not find any association or correlation between the pharmacy program track, high school GPA, GAT score, SAATS score, preparatory year GPA, pharmacy GPA and the SPLE score.

Pharmacology and therapeutic courses' grades were significantly associated with a higher score on the SPLE which could be justified by the SCFHS vision to minimize medication errors and improve patient safety as the pharmacy profession has been shifted toward medical/patient-care rather than manufacturing and sales (Hepler & Strand, 1990). Previously published literature from the USA investigated similar factors to our study; however, their findings differed (Allen & Diaz Jr, 2013; Alston, Battise, & Neville, 2016; Chisholm-Burns et al., 2017; Chisholm-Burns et al., 2014; Madden, Etzler, Schweiger, & Bell, 2012; McCall et al., 2007; Rudolph et al., 2019; Shah, Peng, & Seifert, 2019; Welch & Karpen, 2018).

McCall, K.L et al. studied pre-admission factors, which might have an influence on graduates' passing rate on NAPLEX, and they found that pre-pharmacy GPA, PCAT score, and the CCTST score positively associated with the NAPLEX passing rates (McCall et al., 2007).

Rondall, E et al., studied graduates' performance and their characteristics in pre-pharmacy and pharmacy programs in order to predict NAPLEX passing rates. They found having no D or F grades on pre-pharmacy coursework, together with holding a high cumulative GPA, were the most significant predictors of NAPLEX score passing rates (Allen & Diaz Jr, 2013).

Our study was the first of its kind to be conducted in Saudi Arabia to tackle the SCFHS's qualification exams, and the SPLE in particular. In turn, this research may give an insight into such exams and help us predict factors that may affect future SPLE passing rate and help to rank programs' strengths accordingly. Notwithstanding limitations, our study faced various difficulties, such as reaching out to all of the class of 2019 graduates, combined with the variability and doubt that comes with participants' voluntary reporting and the limitation of a small sample in a single college.

In the future, we are looking forward to investigating proper remediation tools that may improve the SPLE passing rates. We hope to involve more pharmacy colleges from across the Kingdom of Saudi Arabia to generate strong external validity results.

5. Conclusion

This single institution study found that pharmacy GPA, pharmacology and therapeutics courses final grades are significantly associated with SPLE success. Further studies should focus on the GPA cut-off factor below which we should give remediation to improve SPLE passing rates nation-wide. Finally, we need to investigate proper remediation tools to help future pharmacy graduates improve their SPLE test-taking skills, along with advancing the exam's current rates of passing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Ethical approval

Ethical approval No. (HAPO-02-K-012-2019-12-342) was obtained from Umm Al-Qura university's Biomedical Ethics Committee.

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