The Impact of COVID-19 on Pharmacy Student Stress During High-Stakes, Performance-Based Assessments in Skills-Based Courses

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Objective. To compare stress levels of pharmacy students in high-stakes, performance-based assessments administered during skills-based laboratory courses in normal classroom environments versus pandemic classroom environments impacted by COVID-19.

Methods. In 2019, prior to the start of the COVID-19 pandemic, Doctor of Pharmacy (PharmD) students’ stress levels were assessed via a voluntary, paper-based survey before and after performance-based assessments. Students were given a modified version of this survey in 2020 during the pandemic. The 2019 and 2020 survey responses were compared using Wilcoxon rank sum tests.

Results. Pharmacy students reported higher perceived stress levels before performance-based assessments (3.8 vs 3.5) and after performance-based assessments (2.8 vs 2.5) prior to the pandemic compared to during the pandemic. Students identified stress as negatively impacting their performance-based assessment performance in both years (3.4 vs 3.1). Students had similar interest in wellness activities in both phases.

Conclusion. Colleges of pharmacy should consider implementing stress relief programs around high-stakes assessments as well as prioritizing wellness initiatives within curricula.

Keywords: COVID-19, student stress, pharmacy students, assessments

INTRODUCTION

Students in Doctor of Pharmacy (PharmD) programs consistently have higher perceived stress than standard populations.1 Higher stress levels are associated with depression and anxiety, which, in turn, correlate to decreased empathy, lower mental health–related quality of life, and greater use of unhealthy coping mechanisms.1-4 Approximately 77% of students identify pressure to succeed as a major cause of stress.1 Other stressors include finances, concerns about future employment, and personal health.1-5 In 2017, the American Association of Colleges of Pharmacy (AACP) recommended pharmacy schools expand wellness efforts, urging colleges to make “providing support to students a priority.”5 As a result, efforts to better understand and prevent student stress have become increasingly integrated into pharmacy programs.2,5

Current literature suggests that students experience more stress during required high-stakes assessments.6-7 Scores on high-stakes assessments directly affect progression in the pharmacy curriculum and, thus, are used as validation exercises to assure students have achieved set learning objectives.6-12 The high-stakes learning environment is simulated to mimic the gravity of larger-scale examinations, such as the North American Pharmacist Licensure Examination (NAPLEX).8,9

Moreover, there are many unknowns regarding the physiological and environmental impact of the COVID-19 pandemic on students’ educational journeys.5 Xiong and colleagues reported increased levels of anxiety, depression, and post-traumatic stress disorder in general populations during the COVID-19 pandemic. Additionally, student status was associated with increased distress.13

Although some research regarding stress and the COVID-19 pandemic has been published, there is a paucity of data comparing overall stress of pharmacy students in the normal curricula versus in a pandemic-affected environment and how these changes will ultimately affect students and their professional success.5,13 With known
increases in stress during performance-based assessments, pandemic performance-based assessments could result in even higher stress levels among students. This study addresses this gap in literature by disseminating a modified version of a survey in a pandemic-affected environment previously used to assess student stress in a normal classroom environment. This research could inform future wellness efforts made by pharmacy programs.

METHODS
A survey-based, dual-phase design was used to assess first- through third-year (P1-P3) pharmacy students’ perceived levels of stress during high-stakes, performance-based assessments at Purdue University College of Pharmacy. A voluntary, anonymous paper-based survey was administered to students to assess their stress levels directly before and after performance-based assessments in both 2019, referred to as Phase 1, and 2020, referred to as Phase 2. All P1-P3 students at the time of each survey distribution period were eligible to participate. Whereas some students were enrolled in both Phase 1 and Phase 2, individual student data was unable to be linked.

Performance-based assessments take place within the skills laboratory curriculum, which consists of six stand-alone mandatory courses occurring each semester within the first through third years of the PharmD program. Each course contains set performance-based assessment stations, and students must pass each station in order to pass the course and progress in the curriculum. For example, P1 students are assessed on blood pressure, heart rate, and respiratory rate measurement of a standardized patient, compounding calculations, and head, eyes, ears, nose, and throat self-care; P2 students are assessed on counseling skills for antihypertensive medications and diabetes devices as well as problem prioritization using a teaching electronic medical record (tEMR); P3 students are assessed on problem prioritization and a patient case presentation using the tEMR.

For Phase 1 (pre-pandemic), an eight-item survey was developed with the intent to gain a better understanding of the perceived stress PharmD students experience directly before and after high-stakes performance-based assessments. This survey included four five-point Likert-scale items. Two items evaluated perceived stress levels directly before and after performance-based assessments, with 5 = “very high stress” and 1 = “no stress.” One item assessed the impact of stress on performance-based assessment performance, with 5 = “very high impact” and 1 = “no impact.” The fourth item assessed interest in participating in mindfulness activities prior to performance-based assessments in the future, with 5 = “very high likeliness” and 1 = “not very likely.”

The survey also included two open-ended response items asking students how they know they are personally stressed as well as how they alleviate stress related to performance-based assessments specifically. Two additional open-ended items assessed student interest in mindfulness activities. Surveys were paper-based and disseminated over one week in October 2019, directly before and after performance-based assessments during scheduled laboratory course times.

For Phase 2 (midpandemic), the Phase 1 surveys were modified for Phase 2 to include demographic questions and the Cohen Perceived Stress Scale (PSS-10) questionnaire. The PSS-10 is a validated survey instrument developed to assess perceived stress levels in the United States and has been widely used across the United States as well as with pharmacy students. The Phase 2 survey included a total of 21 items: the eight items described for Phase 1, three demographic questions (age, gender, and professional year), and the 10 questions included in the PSS-10. The results from the PSS-10 will be described in a separate manuscript. Consistent with Phase 1, Phase 2 surveys were paper-based and disseminated over one week in October-November 2020, directly before and after performance-based assessments.

For quantitative data, three comparisons were made. Wilcoxon rank sum tests were used to compare the following independent populations: the average perceived stress levels of pharmacy students overall in Phase 1 versus Phase 2 during performance-based assessments and the average perceived stress levels of P1, P2, and P3 pharmacy students in Phase 1 versus Phase 2. For the final comparison, Wilcoxon signed rank tests were used to compare the paired pre– and post– performance-based assessment stress rating differences among P1, P2, and P3 students in Phase 1 as well as Phase 2. An a priori alpha of .05 was used for all statistical tests. Open-ended survey item responses were independently reviewed by two researchers for common themes. Questions asked included, “How do you know when you are stressed?” and “What, if anything, did you do to help alleviate your stress prior to performance-based assessments?” Study approval was received by the Purdue University Institutional Review Board.

RESULTS
In Phase 1 of the study, 426 (94.7%) P1-P3 PharmD students participated compared to 375 (84.2%) students in Phase 2. Demographics of study participants in Phase 2 can be found in Table 1.
Regarding the pharmacy students’ perceived stress levels in Phase 1 versus Phase 2, in Phase 1, students across all professional years reported an average pre–performance-based assessment perceived stress score of 3.8 compared to 3.5 in Phase 2 (Table 2). Students also reported significantly (p < .05) lower stress scores post–performance-based assessment in both phases across all professional years. The average post–performance-based assessment perceived stress score in Phase 1 was 2.8 compared to 2.5 in Phase 2. In both phases, students noted stress as having a moderate to high impact, on average, on performance-based assessment performance. Only P3 students reported stress levels as having a significantly negative impact on performance-based assessment performance (p < .001).

For the differences between pre– and post–performance-based assessment stress ratings among P1, P2, and P3 students in Phase 1 and Phase 2, post–performance-based assessment stress in Phase 2 was significantly less than in the Phase 1 cohort for P1 and P2 students but not for P3 students (p = .22). All students, across both phases and all professional years, experienced a significant decrease in perceived stress directly after their performance-based assessments compared to directly before. The pre-post difference in perceived stress between Phase 1 and Phase 2 was not found to be significant for any professional year (Table 3).

Additionally, student interest in de-stressing activities before and/or after performance-based assessments was assessed. In Phase 1, 288 (68%) of participants and 213 (59%) of respondents in Phase 2 expressed interest in de-stressing mindfulness activities before and/or after performance-based assessments. A few students expressed perceived value in de-stressing activities in general but preferred to spend time practicing on their own rather than participating in wellness activities. Activities students expressed the most interest in included deep breathing (40%-41%) and meditation (32%-33%). Students expressed similar interest in coloring, games, and light stretching across both years (19%-25%).

**DISCUSSION**

In contrast to our hypothesis, respondents’ perceived stress levels were, on average, lower before and after performance-based assessments in Phase 2 (mid-pandemic) versus Phase 1 (pre-pandemic). Several factors may have contributed to this. Consistent with AACP...
recommendations, Purdue University College of Pharmacy hired a Wellness Officer in 2020 to further integrate wellness activities into the curriculum. Additionally, student wellness ambassadors appointed to each professional class stimulated positive discussion regarding health and wellness through weekly emails and social media engagement. Overcoming stress was a prominent focus among the entire college during the 2020-2021 academic year.

Table 2. Perceived Stress by Phase, Professional Year, and Total in Performance-Based Assessments in Skills-Based Courses Before and During a Global Pandemic

| Professional years, by phase | P1 | P2 | P3 | All |
|-----------------------------|----|----|----|-----|
| Phase 1                     |    |    |    |     |
| n                           | 149| 141| 139| 144 |
| (99.3%)^a                   |    |    |    |     |
| Pre-PBA                     |    |    |    |     |
| Perceived level of stress right now, mean (SD)^b | 3.9 (0.8) | 3.5 (0.7) | 3.7 (0.8) | 3.2 (0.8) | 3.7 (1.0) | 3.5 (0.8) | 3.8 (0.9) | 3.5 (0.8) |
| Post-PBA                    |    |    |    |     |
| Perceived level of stress right now, mean (SD)^b | 2.6 (0.9) | 2.3 (0.8) | 2.9 (1.0) | 2.5 (1.0) | 3.0 (1.0) | 2.8 (0.9) | 2.8 (1.0) | 2.5 (0.9) |
| Belief that stress adversely impacted PBA performance, mean (SD)^c | 3.5 (1.0) | 3.0 (0.9) | 3.3 (0.8) | 3.2 (0.8) | 3.5 (0.9) | 3.2 (1.0) | 3.4 (0.9) | 3.1 (0.9) |
| Likelihood to participate in stress relief and mindfulness activities prior to future PBAs, mean (SD)^d | 3.6 (1.0) | 3.3 (1.0) | 3.5 (1.0) | 3.3 (1.0) | 3.3 (1.1) | 3.1 (1.1) | 3.5 (1.1) | 3.2 (1.1) |

Abbreviations: P1=first-year pharmacy students; P2=second-year pharmacy students; P3=third-year pharmacy students; PBA(s)=performance-based assessment(s).

^a Percentage refers to response rate.
^b Response choices using a five-point Likert-type scale, where 1=no stress, 2=low stress, 3=moderate stress, 4=high stress, 5=very high stress.
^c Response choices using a five-point Likert-type scale, where 1=no impact, 2=low impact, 3=moderate impact, 4=high impact, 5=very high impact.
^d Response choices using a five-point Likert-type scale, where 1=not at all likely, 2=not very likely, 3=neutral, 4=somewhat likely, 5=very likely.

Table 3. Comparisons of Pharmacy Students’ Reported Stress Levels Directly Before and After Performance-Based Assessments in Skills-Based Courses During Phase 1 (2019) and Phase 2 (2020) by Professional Year

| Item^a | P1, p value | P2, p value | P3, p value |
|--------|-------------|-------------|-------------|
| Pre-PBA^b | <.001       | <.001       | .04         |
| Post-PBA^b | .007        | .004        | .22         |
| Pre-post change Phase 1^c | <.001      | <.001       | <.001       |
| Pre-post change Phase 2^c | <.001      | <.001       | <.001       |
| Pre-post change, Phase 1 compared to Phase 2^b,d | .21        | .88         | .74         |

Abbreviations: PBA=performance-based assessment; P1=first-year pharmacy students; P2=second-year pharmacy students; P3=third-year pharmacy students.

^a Response choices using a five-point Likert-type scale where 1=no stress, 2=low stress, 3=moderate stress, 4=high stress, 5=very high stress.
^b Wilcoxon rank sum test comparing stress between students enrolled during Phase 1 vs Phase 2, computed first for pre-PBA and then for post-PBA.
^c Wilcoxon signed rank test comparing stress pre-post PBA, by phase.
^d Wilcoxon rank sum test comparing the overall change in perceived stress pre-post PBA, Phase 1 vs Phase 2.
The restructuring of skills-based courses and partial virtual aspects due to the pandemic may have also affected perceived stress levels. Due to the absence of all school-wide breaks, students gained an additional week of class time that was used for performance-based assessment practice in 2020. In Phase 1 of the study, several students noted additional practice would help them feel more prepared and, thus, decrease their stress, and in 2020 students gained this additional practice opportunity organically. Furthermore, the in-person instructional time of most laboratories was decreased from three hours to 1.5 hours in fall 2020. This change was made to accommodate social distancing guidelines. Students wore masks at all times and face shields when actively engaging in activities with other students or laboratory instructors. Whereas all students were in person for performance-based assessments, some cases their evaluators were virtual. The modified length of laboratories conducted in person could have de-escalated students’ stress, as students now had increased autonomy over their time, allowing for more time to practice. Of note, the performance-based assessment length was not modified in Phase 2 despite other changes due to COVID-19.

Previous literature confirms the increased perceived stress of pharmacy students, yet minimal literature regarding perceived stress levels in a customarily stressed student population during a pandemic has been published. A limitation of this study includes the lack of data for P2 students in 2019 and 2020. This class had significantly less participation in the perceived stress pre- and post-surveys for unknown reasons. The addition of the PSS-10 and demographic questions increased the length of the survey in Phase 2 and may have contributed to an overall lower response rate. Another limitation is that the pharmacy students surveyed were from one college of pharmacy, and these findings may not be generalizable to pharmacy students at different schools.

Due to the global pandemic, students have endured unexpected changes and overcome new challenges. Some of these could include, but are not limited to, family members becoming infected with COVID-19, changes to school structure, and finances and/or job security. How students perceive stress associated with performance-based assessments may have decreased in Phase 2 due to their perspective of new stressors and factors that took precedence in their lives because of COVID-19.

Although students reported reduced stress levels in 2020 compared to 2019, students still reported stress and acknowledge its impact on their performance-based assessment outcomes. An increased emphasis on wellness should be a focus in PharmD curricula. Previous literature supports the implementation of stress relief activities such as yoga, mindfulness, and coloring. A majority of students in this study noted interest in participating in similar wellness activities. Additional examples of activities from Schlesselman and colleagues include virtual group exercises, podcast sharing, virtual town halls, email check-ins, pharmacy telehealth, and senior center check-ins. Continued emphasis on wellness in the PharmD curriculum will positively impact pharmacists well into their professional careers.

Areas of future research include exploring the results of the PSS-10 in this study to examine trends in perceived stress levels in pharmacy students during the pandemic. Additionally, the effect of attending university during a pandemic should be studied to address potential mental health implications in young pharmacists.

CONCLUSION
Pharmacy students reported significantly lower stress levels in regard to performance-based assessments during the COVID-19 pandemic compared to performance-based assessments before the pandemic. Increased wellness efforts during this time may have contributed to lower stress levels. However, students still reported stress and expressed similar interest in de-stressing and wellness activities before performance-based assessments during the pandemic. Based on the results of this study, colleges of pharmacy should consider implementing stress relief programs around high-stakes assessments as well as prioritizing wellness initiatives within their curricula.

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REFERENCES
1. Garber MC, Huston SA, Breese CR. Sources of stress in a pharmacy student population. Curr Pharm Teach Learn. 2019;11(4):329-337. doi:10.1016/j.cplt.2019.01.014
2. Hirsch JD, Nemlekar P, Phuong P, et al. Patterns of stress, coping and health-related quality of life in doctor of pharmacy students. Am J Pharm Educ. 2020;84(3):7547. doi:10.5688/ajpe7547
3. Marshall LL, Allison A, Nykamp D, Lanke S. Perceived stress and quality of life among doctor of pharmacy students. Am J Pharm Educ. 2008;72(6):137. doi:10.5688/ajpe7206137
4. Votta RJ, Benau EM. Predictors of stress in doctor of pharmacy students: results from a nationwide survey. Curr Pharm Teach Learn. 2013;5(5):365-372. doi:10.1016/j.cplt.2013.06.014
5. Schlesselman LS, Cain J, DeVall M. Improving and restoring the well-being and resilience of pharmacy students during a pandemic. Am J Pharm Educ. 2020;84(6):677-682. doi:10.5688/ajpe8144
6. Longyhore DL. Pharmacy student anxiety and success with objective structured clinical examinations. *Am J Pharm Educ.* 2017; 81(1):7. doi:10.5688/ajpe8117
7. Attali Y. Effort in low-stakes assessments: what does it take to perform as well as in a high-stakes setting? *Educ Psychol Meas.* 2016;76(6):1045-1058. doi:10.1177/0013164416634789
8. Peeters MJ, Cor MK. Guidance for high-stakes testing within pharmacy educational assessment. *Curr Pharm Teach Learn.* 2020; 12(1):1-4. doi:10.1016/j.cptl.2019.10.001
9. Hunsicker J, Chitwood T. High-stakes testing in nursing education: a review of the literature. *Nurse Educ.* 2018;43(4):183-186. doi: 10.1097/NNE.0000000000000475
10. Gortney J, Rudolph MJ, Augustine JM, et al. National trends in the adoption of pharmacy curriculum outcomes assessment for student assessment and remediation. *Am J Pharm Educ.* 2019;83(6):6796. doi:10.5688/ajpe6796
11. McDonough SL, Kleppinger EL, Donaldson AR, et al. Going “high stakes” with a pharmacy OSCE: lessons learned in the transition. *Curr Pharm Teach Learn.* 2015;7(1):4-11. doi:10.106/j.cptl.2014.09.017
12. Tanzer K, Dintzner M. Promoting professional socialization within the experiential curriculum: implementation of a high-stakes professionalism rubric. *Am J Pharm Educ.* 2017;81(1):19. doi:10.5688/ajpe81119
13. Xiong J, Lipsitz O, Nasri F, et al. Impact of COVID-19 pandemic on mental health in the general population: a systematic review. *J Affect Disord.* 2020;277:55-64. doi:10.1016/j.jad.2020.08.001
14. Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. *J Health Soc Behav.* 1983;24(4):385-396.
15. Cohen S., Janicki-Deverts D. Who’s stressed? Distributions of psychological stress in the United States in probability samples from 1983, 2006, and 2009. *J App Soc Psych.* 2012;42(6):1320-1334. doi: 10.1111/j.1559-1816.2012.00900.x
16. Baik SH, Fox RS, Mills SD, et al. Reliability and validity of the Perceived Stress Scale-10 in Hispanic Americans with English or Spanish language preference. *J Health Psychol.* 2019;24(5):628-639. doi:10.117/1359105316684938
17. Spivey CA, Havrda D, Stallworth S, Renfro C, Chisolm-Burns MA. Longitudinal examination of perceived stress and academic performance of first-year student pharmacists. *Curr Pharm Teach Learn.* 2020;12(9):1116-1122. doi:10.1016/j.cptl.2020.05.002
18. Lemay V, Hoolahan J, Buchanan A. Impact of a yoga and meditation intervention on students’ stress and anxiety levels. *Am J Pharm Educ.* 2019;83(5):7001. doi:10.5688/ajpe7001
19. Jones AM, Clark JS, Mohammad RA. Burnout and secondary traumatic stress in health-system pharmacists during the COVID-19 pandemic. *Am J Health Syst Pharm.* 2021;78(9):818-824. doi:10.1093/ajhp/zxab051