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Research Note

Pharmacy student stress with transition to online education during the COVID-19 pandemic

Omar F. Attarabeen⁎, Chelsea Gresham-Dolby, Kimberly Broedel-Zaugg

Department of Pharmacy Practice, Administration, & Research, School of Pharmacy, Marshall University, One John Marshall Dr., Huntington, WV 25755, United States

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Introduction: Pharmacy student-perceived stress may impact academic experiences. This research aimed to investigate whether there was an increase in student-perceived stress due to the COVID-19 pandemic.

Methods: Current pharmacy students were surveyed in May 2020 at a public pharmacy school that utilizes an active learning design and follows a flipped classroom approach. In addition to measuring perceived stress, the survey measured coping behaviors, self-efficacy, and emotional status. The collected data were compared with archived data that were collected for internal use in 2018. Student's t-test analyses were used to compare 2020 with 2018 data.

Results: A total of 66 students completed the 2020 survey (response rate 26.2%) and 192 students completed the 2018 survey (response rate 63.2%). On a scale from 0 (never or not applicable) to 5 (multiple times each day), average student-perceived stress was 1.75 (SD = 0.93) in 2020. This value of perceived stress presented a slight, but not statistically significant, reduction from 1.85 (SD = 1.04) in 2018. Comparing 2018 and 2020 datasets showed no significant differences in coping behavior, self-efficacy, or emotional status.

Conclusions: Based on the sample with the lower response rate that completed the survey in 2020, student-perceived stress did not increase during online, remote learning associated with the COVID-19 pandemic as compared to the sample with a higher response rate prior to the pandemic. Perhaps the COVID-19 related changes were seamless to students due to their aptitude for remote, online learning.

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Introduction

Stress can be defined as a mental or emotional tension or strain characterized by feelings of anxiety or fear.1 The perception of stress is considered an important mediator linking stressful events to health and well-being as indicated by the Perceived Stress Scale (PSS).2 Several studies have utilized this tool to assess student stress within various student populations. In medical student populations, the PSS indicates that female medical students have higher stress levels, and that burnout and academic satisfaction were strong predictors of stress.3 McKerrow et al.4 reported no changes in perceived stress levels for medical students at a single institution with a novel curriculum throughout the duration of the curriculum when surveyed annually. Another study compared stress between medical students...
and dental students to identify that medical students report stress involving their professional identity while dental students report more stress regarding academic performance and faculty relations.\textsuperscript{5} Polychronopoulou et al.\textsuperscript{6} reported stressors in dental students at six European schools varied significantly among schools with differences in curriculum type (traditional lecture or problem-based learning), class size, and financial concerns.

The Accreditation Council for Pharmacy Education requires United States (US) schools/colleges of pharmacy to monitor stress in students.\textsuperscript{7} Not only is reporting stress important, it is also important to consider the causes of stress, impact of stress, coping mechanisms, self-efficacy, and financial burden. Using the PSS, Votta and Benau\textsuperscript{8} reported that female pharmacy students perceived more stress than males, that Asian students perceived more stress than Caucasian students, and that progression through the professional program along with grade point average correlated negatively with stress. Subsequently, they identified grades, lack of sleep, and unsupportive faculty as being most correlated to higher PSS scores.\textsuperscript{9} Buell et al.\textsuperscript{10} also reported that female students had higher stress levels than males. In addition, class assignments and completing electronic portfolios were most associated with stress. They also identified that students most often relied on spending time with friends and family as a coping mechanism.

Marshall et al.\textsuperscript{11} reported that outside-of-class assignments, examinations and scheduling, and finances were the most common sources of pharmacy student perceived stress, whereas Garber et al.\textsuperscript{12} added that the pressure to succeed in pharmacy school was one of the strongest predictors of perceived stress. Further research by Awe et al.\textsuperscript{13} studied stress and stressors at two multi-campus universities and found no substantial differences between main and branch campuses. A 2017 study led by Chishom-Burns\textsuperscript{14} evaluated attitudes concerning debt, stress, and student loans with respondents indicating that greater fear of debt was associated with higher stress levels and higher loan amounts. Tak et al.\textsuperscript{15} used structural equation modeling to show that professionalism is positively associated with student satisfaction while stress is not a significant factor. Spivey et al.\textsuperscript{16} found that stress increased significantly from the beginning to the end of the first professional year of study and that grade point average (GPA) was negatively correlated to stress levels.

To date, no manuscripts have been published describing pharmacy students’ levels of stress during the COVID-19 pandemic. The purpose of this study was to compare the perceived stress levels obtained during a 2018 internal study with the perceived stress levels after students transitioned emergently to remote learning mid-spring semester 2020 at a public pharmacy school. The method of education during the 2018 study up to the closing of physical academic classrooms in March 2020 was a flipped, team-based learning classroom environment. In this mode of education, students prepared for upcoming classes, received limited classroom lecture material, participated in individual and group readiness assessment tests, and completed active learning exercises, cases, and problems in groups. Due to the COVID-19 pandemic, the university excused students from the physical classrooms one week prior to spring break to provide time for faculty to transition to online classes, continued with the regularly scheduled spring break, and began online classes upon students’ return to virtual classroom. Professors transitioned all coursework from the physical to the virtual in two weeks. Students attended classes virtually utilizing various online meeting spaces, worked in groups online, completed assessments online, and completed all course-related components remotely. The school of pharmacy arranged virtual town hall meetings with students and faculty every week for each class of students to make announcements and encourage discussion until the end of the semester. Some students reported during the town halls that they had not previously enrolled in or completed online courses, others did not have consistent or quality internet service in rural areas, and others were concerned about being successful in the “stay at home” environment due to changes in study habits and routines and, in some cases, sudden need to homeschool dependent children due to physical classroom closures in primary education. Libraries and other campus buildings made improvements to their Wi-Fi ranges so students could be online in parking areas in close proximity while allowing for maintenance of social distancing. Faculty advisors were encouraged to contact advisees frequently until physical return to campus. The hypothesis of this study was that a sudden change in the education environment results in higher stress levels.

\textbf{Methods}

Following an expedited review and approval by the institutional review board office, data collection took place in May 2020 and was compared with archived data the school collected for internal use in 2018. The archived data served as a reference point to compare student perceived stress during the timeframe of social distancing and exclusive online learning due to the COVID-19 pandemic. The archived data set was previously generated by 192 students in spring 2018. Data collection in 2020 used the same structured survey from 2018 to assess the measured constructs. Recruitment was completed by email invitations. Students received individualized survey links so that their GPA, gender, and race/ethnicity information was linked with their responses. The self-administered survey was accessed and completed by participants online. Qualtrics data collection software (Qualtrics Labs) was used as a platform for data collection.

\textbf{Participants}

Current pharmacy students in all program years were invited to participate in the study. None of the students were excluded or found ineligible to participate, and there was an overlap of 145 students who were invited to complete both surveys. A total of 252 students (53 first-professional year [P1], 54 second-professional year [P2], 68 third-professional year [P3], and 77 fourth-professional year [P4]) were invited to complete the survey in 2020, compared with 304 students (68 P1s, 79 P2s, 81 P3s, and 76 P4s) who were invited to participate in 2018.
The survey used the same quantitative questionnaire that was utilized for the internal study, and results were previously published as an abstract in 2018. In both rounds of data collection, students reviewed a consent form and agreed to participate before they were directed to the questionnaire. Prior to data collection in both rounds, the institutional review board reviewed and approved the research study protocol, including the consent, procedures, and questionnaire. The questionnaire included 69 items that were reviewed by a number of survey research methods experts for face and content validity. In addition to assessing perceived stress, the survey also assessed coping behavior, self-efficacy, and emotional status.

Perceived stress was measured by assessing how often the student felt stressed during the past 30 days. Perceived stress was measured across the five domains (each with a specific number of items) including financial capability (eight items), meeting the program requirements (11 items), social interaction and team effectiveness (seven items), successfully completing experiential education requirements (6 items) and post-graduation plans (five items). Each of these 37 items was measured on a 6-point Likert scale that ranged from 0 (never or not applicable) to five (multiple times each day). An overall stress score was calculated for each student by averaging the 37 stress-measuring items.

Ten items assessed student engagement in different activities for the purpose of coping with stress on a 6-point Likert scale (0 = never or not applicable to 5 = multiple times each day). An overall coping behavior score was calculated by computing the average of scores for these ten items. Additionally, self-efficacy was assessed with ten items on a 11-point Likert scale (0 = no confidence to 10 = complete confidence) that evaluated student confidence in their ability to overcome perceived challenges related to finances, meeting the program requirements, social interaction and team effectiveness, completing experiential education, and post-graduation plans. Similarly, an overall self-efficacy score was calculated by computing the average of scores for these 10 items. Further, student emotional status was assessed using nine items on a 5-point Likert scale (0 = never or not applicable to 4 = very often) as measured in previous research. These items investigated whether they were overwhelmed due to school demands, tired due to having a paid job, doubtful concerning ability to handle personal problems, depressed due to inability to handle life difficulties, concerned due to lack of a safe environment, helpless due to many responsibilities, angry or irritated due to unexpected events, or frustrated due to limited interaction with family or friends. An overall emotional status score was calculated by computing the average of scores for these nine items. The survey also evaluated demographics including age, citizenship, and marital status. Prior to removing students’ identifying information from the dataset, grade point average (GPA) values were extracted from student records and were manually added to the dataset in order to prepare for statistical analyses.

Statistical analyses

Although the items were developed based on previously validated surveys, factor analyses (using the principal components method) were conducted for all scales to verify validity. Additionally, reliability was examined by measuring Chronbach’s alpha for all the scales in the survey. A mean stress score was calculated for each of the five stress domains taking the outcomes of the factor analyses into consideration. In addition, all retained stress-measuring items were used to calculate an overall stress score for each student. Likewise, responses for the 10 items that measured coping with stress, the 10 items that measured self-efficacy, and the nine items that measured emotional status were averaged to calculate mean scores for each student on coping with stress, self-efficacy, and emotional status, respectively. The associations between perceived stress and age as well as GPA were examined using Pearson correlation analysis. Furthermore, overall stress scores were broken down by gender, race/ethnicity, and marital status. The statistical difference in stress score by each of these three categories was investigated using Independent student’s t-test. Analysis of variance (ANOVA) was also conducted to examine the difference in stress scores among students in different professional years. Mean stress scores were calculated for each year in the pharmacy program. These statistics were compared between 2018 and 2020 to identify statistical differences. The paired t-test was used to compare perceived stress among students who completed the survey in 2018 and in 2020 after matching their data records. In addition, due to disruptions related to COVID-19 in advanced pharmacy practice experiential learning rotations that placed more restrictions on students’ presence in certain clinical settings, P3 students’ perceived stress was calculated separately from all other students and compared between 2018 and 2020 rounds of data collection.

In order to identify differences in perceived stress prior to and during the COVID-19 pandemic, comparisons between 2018 and 2020 datasets were also made for each of the five stress domains, coping behavior, self-efficacy, and emotional status scores. Independent student’s t-tests were conducted to identify whether there was any significant difference between the two rounds of data collection. Marital status (married or living as married, not married) and race/ethnicity (non-Hispanic White, other races/ethnicities) variables were reclassified into binary variables due to insufficient variation. Finally, both cohorts were combined into one dataset to investigate the predictors of student perceived stress. A new variable was created to denote whether each record was collected in 2018 or during the COVID-19 pandemic in 2020. Linear regression analysis was conducted to answer this question. Statistical analyses were completed with SPSS, version 24 (IBM Corporation). A P value of < .05 was considered statistically significant.

Results

Compared with 192 students who participated in the survey in 2018 (response rate 63.2%), a total of 66 students completed the survey in 2020 (response rate 26.2%), yielding an overall response rate of 46.4%. Mean age for participants slightly but significantly increased from 25.2 years in 2018 to 26.7 years in 2020 (t(254) = −2.113, P = .04). No significant difference in GPA was observed between the two cohorts (t(256) = −1.090, P = .28). Comparing the sample composition between 2018 and 2020 cohorts revealed no
difference in gender ($\chi^2[1] = 1.793, P = .18$) and race/ethnicity ($\chi^2[1] = 0.303, P = .58$). However, the 2020 study participants were significantly more likely to be married or living as compared to the 2018 participants ($\chi^2[1] = 16.435, P < .001$).

The factor analyses revealed multicollinearity between two of the items measuring post-graduation stress. The item that was less heavily loaded on the same Eigenvalue as other items in the scale was dropped. No multicollinearity was identified among the items of all other scales. The Kaiser-Meyer-Olkin values ranged from 0.795 to 0.905, with all scales having significant Bartlett’s tests of sphericity ($P < .001$), indicating sampling adequacy for each scale. Further, all retained items were fairly loaded on the same Eigenvalues. Reliability was checked by calculating Cronbach’s alpha and was found above 0.70 for all scales, indicating good internal consistency, and therefore, decent quality of the survey scales.

**Association between perceived stress and student basic characteristics**

Student GPA was inversely associated with student perceived stress in both the 2018 cohort ($r = -0.196, n = 192, P = .006$) and the 2020 cohort ($r = -0.315, n = 66, P = .01$). Although a higher age was associated with greater perceived stress in 2018 data ($r = 0.0169, n = 190, P = .02$), there was no significant association between these two variables in 2020 data ($r = 0.096, n = 66, P = .44$). Description of categorical demographic variables and perceived stress values are presented in Table 1. The table demonstrates that in 2018, perceived stress was higher in female students compared to male students ($t[190] = 2.092, P = .04$), and in minority students compared to non-Hispanic white students ($t[190] = -3.893, P < .001$). No significant differences in perceived stress values were observed across any categories in 2020 as shown in Table 1.

**Stress comparison between 2018 and 2020 cohorts**

The mean (M) perceived stress value across all students declined from 1.85 (SD = 1.04) in 2018 to 1.75 (SD = 0.93) in 2020 but was not statistically different ($t[256] = 0.707, P = .48$). For students who completed the survey in 2018 and 2020 ($n = 27$), mean stress changed from 1.68 (SD = 1.06) in 2018 to 1.78 (SD = 1.10) in 2020, but this difference was not statistically significant ($t[27] = -0.550, P = .59$). Further, there were no significant differences in the five measured domains of stress between 2018 and 2020 (Table 2). In addition, there were no statistical differences between 2018 and 2020 in the observed coping scale, self-efficacy, and emotional status. Furthermore, the ANOVA results showed no statistically significant difference in perceived stress among different professional years in 2018 ($F[3,62] = 2.174, P = .09$) as well as in 2020 ($F[3,62] = .386, P = .76$).

Perceived stress per class and its comparison between the two rounds of data collection is presented in Table 3. As shown in the table, stress by professional year did not change in 2020 compared to 2018. However, when compared with students in other professional years combined, the third year students in 2018 reported higher perceived stress (M = 2.17, SD = 1.00) relative to other students (M = 1.75, SD = 1.04) in 2018, and this difference was statistically significant ($t[190] = -2.414, P = .02$). However, the difference between P3 students-perceived stress in 2020 (M = 1.89, SD = 1.13) and students-perceived stress in other professional years in 2020 (M = 1.71, SD = 0.87) was not statistically significant ($t[64] = 0.664, P = .51$).

**Table 1**

Associations between perceived stress and demographic categories, 2018 and 2020.

|           | n (%) | $M^a$ (SD) | Statistical difference between the categories |
|-----------|-------|-----------|---------------------------------------------|
| 2018 data |       |           |                                             |
| Gender    |       |           |                                             |
| Female    | 104 (54.2) | 2.00 (1.05) | $t(190) = 2.092, P = .04$ |
| Male      | 88 (45.8)  | 1.68 (1.02) |                                             |
| Race/ethnicity |       |           |                                             |
| Non-Hispanic White | 151 (78.6) | 1.71 (0.97) | $t(190) = -3.893, P < .001$ |
| Other races/ethnicities | 41 (21.4) | 2.40 (1.13) |                                             |
| Marital Status |       |           |                                             |
| Married or living as married | 34 (17.7) | 1.84 (1.09) | $t(190) = -0.085, P = .93$ |
| Not married | 158 (82.3) | 1.86 (1.04) |                                             |
| 2020 data |       |           |                                             |
| Gender    |       |           |                                             |
| Female    | 42 (63.6)  | 1.69 (0.74) | $t(64) = -0.707, P = .48$ |
| Male      | 24 (36.4)  | 1.86 (1.20) |                                             |
| Race/ethnicity |       |           |                                             |
| Non-Hispanic White | 54 (81.8) | 1.67 (0.95) | $t(64) = -1.424, P = .16$ |
| Other races/ethnicities | 12 (18.2) | 2.09 (0.74) |                                             |
| Marital Status |       |           |                                             |
| Married or living as married | 28 (42.4) | 1.58 (0.75) | $t(64) = -1.300, P = .20$ |
| Not married | 38 (57.6) | 1.88 (1.03) |                                             |

$M^a$ = mean.

$^a$ Stress mean was calculated on a scale from 0 to 5.

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The linear regression analysis showed that higher scores in the coping behavior and emotional status scales were associated with a higher perceived stress score. Additionally, a higher score in the self-efficacy score was associated with a lower perceived stress value. In terms of demographic factors, minority students were more likely to score higher in the perceived stress scale compared to non-Hispanic white students. No other demographic factors were associated with perceived stress. Contrary to our hypothesis, student-perceived stress values were not significantly influenced by the COVID-19 pandemic. More details are presented in Table 4. Collinearity diagnostics showed that the variance inflation factor did not exceed 2.0, indicating no significant multicollinearity among the independent variables.

In summary, data on student-perceived stress as measured from the 2020 sample does not suggest a change from student-perceived stress recorded in 2018. This lack of significant difference was consistent across all program years (P1, P2, P3, and P4 year) and across all measured stress domains. Despite demonstrating significant associations with student-perceived stress, coping behavior, self-efficacy, and emotional status did not significantly change during the COVID-19 pandemic compared to their recorded values in 2018.

### Table 2
Comparison of constructs between 2018 and 2020.

| Construct                                | M (SD) in 2018 | M (SD) in 2020 | Statistical difference |
|------------------------------------------|----------------|----------------|------------------------|
| Overall Stress                           | 1.85 (1.04)    | 1.75 (0.93)    | t(256) = 0.707, P = .48 |
| Finances-related                         | 1.55 (1.13)    | 1.50 (1.10)    | t(256) = 0.328, P = .74 |
| Meeting the program requirements         | 2.26 (1.22)    | 2.06 (1.13)    | t(256) = 1.215, P = .23 |
| Social interaction and team effectiveness| 1.26 (1.10)    | 1.19 (0.97)    | t(256) = 0.407, P = .69 |
| Completing experiential education        | 1.63 (1.43)    | 1.49 (1.37)    | t(256) = 0.657, P = .51 |
| Post-graduation plans                    | 2.71 (1.64)    | 2.77 (1.46)    | t(256) = −0.266, P = .79 |
| Mean coping behavior                     | 1.38 (0.76)    | 1.41 (0.76)    | t(256) = −0.324, P = .75 |
| Mean self-efficacy                       | 7.19 (1.85)    | 7.47 (1.45)    | t(256) = −1.118, P = .27 |
| Mean emotional stability                 | 1.70 (0.84)    | 1.57 (0.84)    | t(256) = 1.050, P = .30 |

M = mean.  
a Item was measured on a scale from 0 to 5.  
b Item was measured on a scale from 0 to 10.  
c Item was measured on a scale from 0 to 4.

### Table 3
Comparison of class-specific perceived stress between 2018 and 2020.

|                  | 2018             | 2020             | Statistical difference |
|------------------|------------------|------------------|------------------------|
|                  | n M (SD)         | n M (SD)         | t               |
| P1 students      | 57 1.83 (1.06)   | 16 1.88 (0.92)   | t(71) = −0.168, P = .87 |
| P2 students      | 65 1.74 (1.02)   | 15 1.62 (0.79)   | t(78) = 0.407, P = .69 |
| P3 students      | 46 2.17 (1.00)   | 15 1.89 (1.13)   | t(59) = 0.920, P = .36 |
| P4 students      | 24 1.61 (1.09)   | 20 1.64 (0.91)   | t(42) = −0.088, P = .93 |

M = mean; P1 = first-professional year; P2 = second-professional year; P3 = third-professional year; P4 = fourth-professional year.

### Predictors of student perceived stress

The linear regression analysis showed that higher scores in the coping behavior and emotional status scales were associated with a higher perceived stress score. Additionally, a higher score in the self-efficacy scale was associated with a lower perceived stress value. In terms of demographic factors, minority students were more likely to score higher in the perceived stress scale compared to non-Hispanic white students. No other demographic factors were associated with perceived stress. Contrary to our hypothesis, student-perceived stress values were not significantly influenced by the COVID-19 pandemic. More details are presented in Table 4. Collinearity diagnostics showed that the variance inflation factor did not exceed 2.0, indicating no significant multicollinearity among the independent variables.

In summary, data on student-perceived stress as measured from the 2020 sample does not suggest a change from student-perceived stress recorded in 2018. This lack of significant difference was consistent across all program years (P1, P2, P3, and P4 year) and across all measured stress domains. Despite demonstrating significant associations with student-perceived stress, coping behavior, self-efficacy, and emotional status did not significantly change during the COVID-19 pandemic compared to their recorded values in 2018.

### Table 4
Linear regression on the factors associated with perceived stress.

|                  | B    | Significance level | 95.0% CI for B |
|------------------|------|--------------------|----------------|
|                  |      |                    | Lower bound    | Upper bound    |
| (Constant)       | 1.037| .07                | −.066          | 2.140          |
| Gender           | −.046| .63                | −.230          | .138           |
| Age              | .009 | .35                | −.010          | .029           |
| Race/ethnicity   | .446 | < .001             | .217           | .675           |
| Marital status   | .053 | .54                | −.169          | .275           |
| Class year       | −.019| .66                | −.106          | .068           |
| GPA              | −.137| .11                | −.304          | .031           |
| Coping behavior  | .360 | < .001             | .233           | .487           |
| Self-efficacy    | −.078| .007               | −.134          | −.022          |
| Emotional status | .552 | < .001             | .432           | .672           |
| COVID-19 pandemic| .008 | .94                | −.204          | .220           |

B = unstandardized coefficients; GPA = grade point average.
Discussion

The specific aim of this survey-based study was to identify if student-perceived stress changed significantly from a typical time of student participation in the pharmacy program to an atypical, previously unexperienced type of participation during the remote learning environment necessitated by the COVID-19 pandemic. No statistical differences were noted from the time of initial data collection in 2018 to the time of data collection during the COVID-19 pandemic in 2020. Therefore, we concluded that the group of respondents with the lower response rate, who completed the survey during the COVID-19 pandemic, reported a similar stress level to what the larger sample reported in 2018 prior to the pandemic. Nevertheless, our results should be interpreted with caution due to low response rate during the pandemic data collection point.

The authors predicted that student-perceived stress may be higher in certain domains, particularly those domains related to finances and to completing experiential education requirements. Given that the unemployment rate in the US increased from 3.8% in February 2020 to 13.0% in May 2020,20 there was concern that students could be directly impacted by layoffs and workplace closures through either their own positions or those of family members. Regarding financial stress, the Coronavirus Aid, Relief, and Economic Security Act included a Higher Education Emergency Relief Fund with the purpose of providing more than $14 billion in emergency funding to higher education, with $6 billion dedicated to student grants to be awarded for expenses related to the disruption of campus operations due to the COVID-19 pandemic.21 This may have been a mitigating factor in student perception of financial stress. It is also possible that students may have not been affected by unemployment to the same extent as the general US population due to higher likelihood of employment as an essential worker within a community pharmacy or other pharmacy environment. Given that student experiential rotations were moved to remote learning, canceled, or changed quickly to alternative sites in majority of pharmacy programs in the US22 in response to the COVID-19 pandemic and resulting changes in pharmacies, it was anticipated that students may have heightened stress regarding completing their experiential rotations at this time. Overall, students did not report higher stress levels related to completing experiential rotations than when previously surveyed, perhaps due to timing of survey administration in 2020; as this survey was administered in May, any initial issues with rotation changes were likely addressed by this time with alternative plans or sites, as needed. After moving to remote, online learning, students were invited to weekly townhall-style meetings with faculty and administration and received information and were able to ask questions about coursework, experiential rotations, or any other concerns, which may have decreased student stress through providing reassurance and transparency. Due to faculty using a flipped classroom model prior to the move to remote learning, it is possible that students already were accustomed to a degree of student-controlled learning of content.

This research sought to compare student-perceived stress during a time of typical curriculum completion and a time of atypical, virtual curriculum completion and is unlike other known published work on the topic of student stress. To our knowledge, the most similarly designed research, a study from McKerrow et al.,4 demonstrated statistically similar levels of student-perceived stress throughout the duration of the curriculum when assessed annually. Although our study differs in design, our findings are consistent with this study in that student stress remains consistent at varying years in curricular progression, with the additional variable of changing academic circumstances.

This cross-sectional research adds to the understanding of student perception of stress in the midst of a global pandemic. As society responded to the COVID-19 pandemic, anecdotally, many stressors were noted by faculty in making the transition to online learning from in-classroom learning. It was predicted that students would have increased stress levels regarding completing their coursework and managing any new or changing stressors, whether they be personal (family or dependent-related care), social, financial, or academic. However, it is possible that student stress remained similar to the baseline data collected as the requirements of the pharmacy program ultimately did not change due to the COVID-19 pandemic; class time was still held virtually, assignments were still due, final presentations were still given, and final exams were still administered. This preliminary study could provide the implication that enrollment in a pharmacy program is inherently associated with a baseline level of stress that perhaps is not readily impacted by changes in curricular delivery. While it was not measured in our study, resilience among pharmacy students also likely plays a role in the results of this data comparison. With this knowledge, variation in educational methods and curricular delivery can occur while potentially not causing statistically significant variations in student stress level. This could allow faculty to potentially explore course delivery methods responsibly without impacting student-perceived stress.

Our study had several limitations. First, our sample size was small, and there was a lower response rate in the 2020 administration of the survey. During the 2018 round of data collection, students were given time at the beginning of a class to complete the survey. However, this was not possible during remote learning in 2020. Second, due to two of the original cohorts of students surveyed in 2018 completing the pharmacy program and new cohorts of students being admitted in 2018 and 2019, survey samples could not be paired due to lack of directly overlapping populations. Also, as two of the student cohorts were surveyed in both studies, the survey samples were not completely independent. This study was also conducted at a single institution and may not be reflective of student perception at other institutions. Lastly, our initial student-perceived stress survey was administered during a time of transition within the school of pharmacy with administrative turnover within the university and the school which may have potentially impacted the students’ perception of their stress as it pertained to the pharmacy program. Future studies are encouraged to validate the scales using larger samples in order to increase the robustness and reliability of the findings.

There are numerous directions for future research regarding the COVID-19 pandemic and student-stress. Future research could examine long-standing impact on student stress and student learning as the COVID-19 pandemic continues to potentially decrease or surge in the coming months to years. The role of resilience, especially as it correlates with perceived stress, could be explored in the context of learning during the pandemic. It could also be examined as to what students prefer in terms of online, in-person, or hybrid learning models in terms of what causes the least amount of student-perceived stress without impacting learning and knowledge retention.
Comparisons in student perceptions and stress in institutions with different pedagogical models during periods of remote learning could clarify what types of educational strategies translate to the least stressful online classroom experiences. Future research could also explore faculty-perceived stress during the COVID-19 pandemic and subsequent move to online learning.

Conclusions

Data from the limited group of respondents that we recruited in 2020 suggested that the COVID-19 pandemic may not have had a negative impact on student-perceived stress. This finding may be specific to this school considering its unique flipped, team-based learning, classroom environment. Due to a low response rate during the pandemic, these results are preliminary and further study with larger groups of students and more representative samples are indicated. Nevertheless, perhaps this technology-oriented generation of students was able to communicate with instructors and school employees online just as effectively as they would in a typical face-to-face environment. Another explanation is that perhaps potential stress was relieved by students moving back to their hometowns and staying with parents, family, or friends. Finally, remote, online teaching may potentially be a preferred mode of learning for students in the future, especially after going through this experience with no evidence of increased perceived stress.

Disclosure(s)

None.

Declaration of Competing Interest

None.

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