

RESEARCH ARTICLE

# Pharmacy students' perceptions of a transition to a virtual curriculum and their mental health implications

Katherine Muilenburg<sup>1</sup>, Crystal K Hodge<sup>1,2</sup>, Annesha White<sup>1</sup>

<sup>1</sup> Department of Pharmacotherapy, University of North Texas Health Science Center College of Pharmacy, Texas, United States

<sup>2</sup> Department of Pharmacy, University of Texas Southwestern Medical Center, Texas, United States

## Keywords

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## Correspondence

Crystal Hodge  
Department of Pharmacotherapy  
University of North Texas Health  
Science Center College of Pharmacy  
Texas  
United States  
crystal.howell@unthsc.edu

## Abstract

**Objective:** The purpose of this study was to assess pharmacy students' satisfaction with a transition to a remote pharmacy curriculum in the pandemic setting. **Methods:** This was a cross-sectional study conducted in Autumn 2020. Participating pharmacy schools distributed an anonymous survey link to their pharmacy students. The survey evaluated student perceptions of virtual learning, barriers to success, solutions, mental health, and the validated Perceived Stress Scale (PSS-10). Descriptive and inferential statistics were used to analyse the data. **Results:** A total of 488 students responded to the survey. The majority of participating students were female (78%), 25-30 years old (68%), and racially diverse. Feelings of isolation were reported by 62% of students. Three-quarters of students disagreed or strongly disagreed that their motivation to study increased during quarantine. During quarantine, the PSS-10 revealed a statistically significant decline in mental health. **Conclusion:** This study identified barriers and solutions to student success in a virtual curriculum. The results also highlighted the need for support for pharmacy students' mental health resources and advocacy.

## Introduction

In 2020 the world, including the world of pharmacy education, dramatically changed due to the Coronavirus Disease 2019 (COVID-19). The World Health Organization (WHO) declared COVID-19 as a pandemic on 11 March 2020. Stay-at-home orders were first issued in California on 19 March, with numerous states to follow (Moreland A, 2020; Staff, 2021). In order to promote social distancing and comply with local stay-at-home orders, many pharmacy educators scrambled to convert curricula from in-person to virtual formats. The American College of Pharmacy Education (ACPE) provided several guidance documents to Deans of Colleges of Pharmacy to facilitate national challenges faced while adopting remote pharmacy curricula (Engle, 2020). However, students were asked to adjust their learning methodologies to a variety of contexts, including remote, live but with a limited number of persons,

synchronous, and asynchronous. As a result, the COVID-19 pandemic presented significant challenges to educational systems, student learning, as well as student mental health. Studies revealed increased concerns for student mental health across the health professions (Ibrahim & Abdelreheem, 2015; Fischbein & Bonfine, 2019).

It has been previously established that health professions students are at a heightened risk of experiencing anxiety and depression (Roberts *et al.*, 2001; Ibrahim & Abdelreheem, 2015; Rotenstein *et al.*, 2016; Fischbein & Bonfine, 2019). The incidence of depression among medical students has been reported to be between 18%-54%. Additionally, the incidence of anxiety among medical students has been reported to be between 19% and 44% (Roberts *et al.*, 2001; Ibrahim & Abdelreheem, 2015; Rotenstein *et al.*, 2016). The prevalence among pharmacy students is similar, with 51% reporting symptoms of depression, 29% reporting

symptoms of anxiety, and a statistically significant decrease in health-related quality of life compared to the overall United States population for the age group (Ibrahim & Abdelreheem, 2015; Fischbein & Bonfine, 2019). Although the prevalence of mental illness is high in this population, seeking medical treatments for such conditions remains low (I. Liu *et al.*, 2020). It has been suggested that pharmacy students are less likely than their medical student counterparts to seek out mental health resources which present a considerable area for improvement (Fischbein & Bonfine, 2019). Furthermore, this predilection to mental health that extends from pharmacy school into practice has become increasingly recognized by accrediting bodies, including ACPE and the American Association of Colleges of Pharmacy (AACP) ("*Commitment to Clinician Well-Being and Resilience*").

A 2019 initiative entitled Enhancing Well-being and Resilience among the Pharmacy Workforce was offered by AACP in partnership with the American Pharmacists Association, the Accreditation Council on Pharmacy Education, the National Alliance of State Pharmacy Associations, and the National Association of Boards of Pharmacy. The consensus conference promoted a culture of well-being among students considering strategies for the future of the pharmacy profession (APhA, 2019). These efforts were prompted before the COVID-19 pandemic quarantine efforts and now have become timely considering the historical data available on exacerbations of mental health in the setting of a pandemic (Pan, Chang, & Yu, 2005; X. Liu *et al.*, 2012; Sprang & Silman, 2013; Brooks *et al.*, 2020; Dresser, Whitfield, Kremer, & Wilby, 2021). In addition to these prior works, a study by Liu and colleagues demonstrated that longer quarantine durations negatively correlated with mental health; we have now surpassed the two-year anniversary of the COVID-19 pandemic (I. Liu *et al.*, 2020; Staff, 2021).

The emergent transition of educational curricula to an online format has posed many challenges for pharmacy students and faculty educators. In spite of the possible negative consequences of self-quarantine and social distancing measures that were embraced during the COVID-19 pandemic, the full extent of the effects of the transition to an online pharmacy program has yet to be analyzed. This survey study aimed to examine student pharmacist satisfaction with the emergent transition to a remote pharmacy curriculum in the setting of a national pandemic. The secondary aim of the study was to determine whether there was an association between mental health and the transition to a remote curriculum among pharmacy students.

## Methods

This was a descriptive, cross-sectional study to describe student pharmacist adjustments to a virtual pharmacy curriculum in the pandemic setting. The survey questions were developed based on the available literature, uploaded to Qualtrics (Provo, UT), and reviewed to ensure consistency and content. This anonymous 40-question student survey was institutional review board (IRB) approved and consisted of sections on demographics, prior history with virtual learning, current experiences with virtual learning, and existing mental health history. Additional questions added were adapted from the Perceived Stress Scale -10 (PSS-10). The PSS-10 is a validated survey freely available for academic research (Cohen, Kamarck, & Mermelstein, 1983). Inclusion criteria for participation in the survey were age 18 years or older and current enrollment as a student pharmacist in a United States pharmacy school. To improve the accuracy of survey results, responses were excluded if the duration of completing the survey was less than 60 seconds.

Pharmacy schools were designated as public or private, and the region within the United States was defined by the Centers for Disease Control and Prevention (CDC) and the Department of Health and Human Services (HHS) (Registry, 2021). Geographic consideration was added post hoc, given the variety of local methods of enforcing stay-at-home orders, which could impact student perceptions of the transition and mental health implications. The survey was designed to be largely multiple-choice to provide quantitative data. Select open-ended questions were included for qualitative data, such as, "*please explain your adjustment in the transition to virtual learning during quarantine.*"

A survey distribution contact list was developed by searching the online websites for each United States school/college of pharmacy. Two e-mails were sent to each school/college representative requesting participation and distributing the anonymous student survey link. Student participants provided informed consent. An introductory e-mail was sent on 6 October 2020, and a reminder e-mail on 21 October 2020. A final e-mail was sent to programmes with low response rates extending the survey close date to 3 December 2020. The e-mail included a note that in exchange for participating in the survey study and distributing the link to students, individual programme reports would be shared upon the conclusion of the study.

In addition to Qualtrics analysis reports, SPSS Statistics (v.25.0, IBM, Armonk, NY) was used to analyse the survey data. Demographic, transition to online learning, and mental health questions were analyzed using descriptive statistics. The student served as their own comparator when they completed the Likert scale on the

PSS-10 before and during quarantine. Categorical data from the responses were averaged and compared using a paired t-test with two-tailed significance. A *p*-value of 0.05 or less was considered significant.

**Results**

Initially, there were 536 student participants. After exclusion criteria were applied, 488 student responses remained valid. Students from participating pharmacy programmes largely represented public pharmacy schools and were in either region two, five, or six. Table I includes further details on the distribution of participating programmes, including the prevalence of self-reported mental health disorders.

The majority of student participants were single, Caucasian, female, and did not have children. There was an approximately equal distribution amongst years of pharmacy school as of August 2020, with a slight decrease in the number of participants that were fourth year pharmacy students. Table II provides additional demographic data. Prior to pharmacy school, 68.8% of the students had previously participated in an online course, with 42.2% of those being science courses. If available, 57.4% would not have been interested in taking an online course. Within the pharmacy curriculum prior to quarantine, 19% of pharmacy students had previously had an online course. In addition, 30% of pharmacy students reported a history of depression, and 42.5% reported a history of anxiety.

**Table I: Region and school demographics (N=488)**

Demographic	Number (%)	History of depression Number (%)	History of anxiety Number (%)
<b>Type of pharmacy school</b>			
Public	378 (77.5)	99 (26.2)	146 (38.6)
Private	110 (22.5)	33 (30)	41 (37.3)
<b>CDC region of school</b>			
1	0	0	0
2	104 (21.2)	26 (25)	35 (33.7)
3	27 (5.5)	9 (33.3)	14 (51.9)
4	48 (9.8)	16 (33.3)	25 (52.1)
5	101 (20.6)	39 (38.6)	46 (45.5)
6	174 (35.4)	35 (20.1)	54 (31)
7	6 (1.2)	2 (33.3)	2 (33.3)
8	10 (2.0)	5 (50)	6 (60)
9	16 (3.3)	0 (0)	4 (25)
10	0	0	0

The primary objective of this survey was to describe how pharmacy students adjusted to the rapid transition to virtual learning in the setting of a pandemic. Roughly two-thirds of pharmacy students indicated that the transition to virtual learning was difficult. Responses to the free-response question about the transition had the following themes: difficulties associated with new processes, loss of routines, and more frequent interruptions/distractions due to being at home. Nearly one-third of pharmacy students identified that an experiential rotation, advanced or introductory, was cancelled due to the pandemic. Of the 296 students (66.1%) that utilised study groups prior to quarantine, 44.6% disagreed, and 28.9% strongly disagreed that their study groups were as effective as before quarantine. When asked to quantify the degree of variance in their studying and learning methodology during quarantine, 67.6% of 448 pharmacy students indicated that they had to change more than 50% of their prior study and learning habits. Roughly 52% and 15% agreed and strongly agreed, respectively, that

there was adequate structure to facilitate learning without in-person classes during quarantine. The transition to online learning was believed to be probably and definitely necessary and effective by 49.9% and 40.2%, respectively. Around 35% of pharmacy students disagreed that their level of motivation increased during quarantine, and 41.8% strongly disagreed. Combined, this indicates that approximately three-fourths of pharmacy students had declining motivation to study during quarantine. Classwork and/or studying during quarantine was identified as more difficult for 65.9% of pharmacy students. About 45% of pharmacy students did not believe their grades for Spring 2020 were reflective of their abilities, and approximately 68% of those students indicated that their grades were somewhat worse. The majority of students reported daily communication with friends and family at 53.6%, and another 17% reported communicating at least four times weekly.

**Table II: Demographic characteristics (N=488)**

Demographic	Number of students responding (%)
<b>Age</b>	
<18	2 (0.4)
18-24	297 (58.2)
25-30	133 (26.1)
31-35	40 (7.8)
36+	38 (7.5)
<b>Self-identified Gender</b>	
Male	129 (2.35)
Female	369 (72.4)
Other	3 (0.6)
Not disclosed	9 (1.8)
<b>Ethnicity</b>	
White	232 (45.8)
Black	56 (11.1)
Hispanic	106 (20.9)
American Indian	1 (0.2)
Asian or Pacific Islander	87 (17.2)
Other	19 (3.8)
Not disclosed	6 (1.2)
<b>Marital status</b>	
Single	389 (76.7)
Married	98 (19.3)
Domestic Partnership	18 (3.6)
Divorced	1 (0.2)
Widowed	1 (0.2)
<b>Children</b>	
0	451 (89)
1	22 (4.3)
2	16 (3.2)
3+	18 (3.6)
<b>Year in pharmacy school as of August 2020</b>	
P1	122 (24.8)
P2	146 (29.7)
P3	138 (28.1)
P4	85 (17.3)

Live lectures or a combination of live and recorded lectures for non-lab-based pharmacy courses were identified by approximately 66% of participants as their preferred learning style. Asynchronous recorded lectures alone were preferred by 19% of pharmacy students. Pharmacotherapy courses were identified as the courses with the least student pharmacist interest in only asynchronous delivery of course content. Table III portrays the distribution of pharmacy courses identified by pharmacy students as appropriate for asynchronous delivery. If pharmacy courses were delivered solely through asynchronous, recorded lectures, 57.7% of participants believed they would be able to keep up with the weekly lectures as scheduled. If courses were delivered asynchronously, about 84% of students wished to meet live for some activities. Of those that indicated a preference to meet live, 35.9% preferred to meet once

weekly and 43.3% preferred to meet two to three times weekly. Almost half (41.3%) of pharmacy students indicated that their primary preference for communicating with professors to ask questions was to e-mail as needed for asynchronous lectures. Other methods suggested by pharmacy students in open response questions were weekly review sessions, office hours, and in-person reviews. Notably, students self-identified that they preferred optional structured content for any live meetings.

**Table III: Pharmacy students' self-reported interest in asynchronous course delivery (N=488)**

Course	Number of students responding (%)
Electives	325 (14.05)
Pharmacy Law	296 (12.80)
Drug Information and Literature Evaluation	295 (12.75)
Management	292 (12.62)
Self-Care (OTC)	260 (11.24)
Pharmacology	184 (7.96)
Pharmaceutics	171 (7.39)
Medicinal Chemistry	165 (7.13)
Pharmacokinetics	163 (7.05)
Pharmacotherapy Courses	162 (7.0)

Potential barriers to satisfaction with a virtual curriculum included that 78% of students with children (n=50) were newly responsible for their education. Childcare impacted 70% (n=35) of pharmacy students with children's ability to study. Additionally, 84.1% (n=446) experienced "Zoom fatigue" (the feeling of exhaustion from video conferences, lectures, and meetings) at some point during quarantine and roughly two-thirds of pharmacy students experienced technical difficulties that interfered with their learning. Unreliable internet or connection issues were the predominant barriers expressed by pharmacy students in free-response answers.

Averages of responses from the adapted PSS-10 prior and during the quarantine were compared in Tables IV and V. Table V shows that there were statistically significant changes in all questions demonstrating a negative impact on responses from before to during quarantine. Only 20.9% of 440 pharmacy students indicated utilising mental health support services while quarantined. Feelings of isolation during quarantine were reported by 62% (n=440) of pharmacy students. A total of 83% of pharmacy students reported changes in levels of daily activity. Of those that indicated a change in their activity level, 49.6% of pharmacy students noted a decrease in activity by at least 50%, and 25.7% reported an increase of activity level by at least 50%.

**Table IV: Pharmacy students' perceived stress scale responses (N=409)**

	Number (%)						
	Before quarantine			Weekly 4	Every other week 5	Monthly 6	Never 7
Daily 1	4-6 days/week 2	2-3 days/week 3					
How often have you felt you weren't able to control the priorities in your life?	29 (7.1)	34 (8.3)	53 (13.0)	71 (14.5)	71 (14.5)	80 (19.6)	71 (14.5)
How often have you felt stressed and anxious?	69 (16.9)	51 (12.5)	86 (21.0)	78 (19.1)	55 (13.4)	46 (11.2)	24 (5.9)
How often have you felt able to deal with your personal struggles?	123 (30.1)	80 (49.6)	70 (17.1)	66 (16.1)	32 (7.8)	19 (4.6)	19 (4.6)
How often have you handled irritating life hassles with success?	89 (21.8)	101 (24.7)	65 (15.9)	84 (20.5)	27 (6.6)	30 (7.3)	13 (3.2)
How often have you felt you were coping successfully with big developments that were occurring in your life?	79 (19.3)	96 (23.5)	76 (18.6)	75 (18.3)	33 (8.1)	32 (7.8)	18 (4.4)
How often have you felt that life was going your way?	69 (16.9)	97 (23.7)	59 (14.4)	71 (17.4)	46 (11.2)	38 (9.3)	29 (7.1)
How often have you felt you were unable to handle all the tasks you had to do?	35 (8.6)	51 (12.5)	85 (20.8)	68 (16.6)	75 (18.3)	60 (14.7)	35 (7.1)
How often do you find yourself worrying about things that you need to achieve?	105 (25.7)	60 (14.7)	84 (20.5)	74 (18.1)	44 (10.8)	27 (6.6)	15 (3.7)
How often have you felt struggles were adding up so much that you could not handle them?	45 (11.0)	42 (10.3)	68 (16.6)	68 (16.6)	53 (13.0)	76 (18.6)	57 (13.9)
How often have you felt that you were on the ball with tasks you needed to accomplish?	62 (15.2)	88 (21.5)	104 (25.4)	66 (16.1)	41 (10.0)	29 (7.1)	19 (4.6)
How often were you able to control how your time was spent?	82 (20.0)	107 (26.2)	87 (21.3)	63 (15.4)	33 (8.1)	20 (4.9)	17 (4.2)
How often have you become angry due to things that were not in your control?	24 (5.9)	38 (9.3)	59 (14.4)	77 (18.8)	55 (13.4)	87 (21.3)	69 (16.9)

	Number (%)						
	After quarantine			Weekly 4	Every other week 5	Monthly 6	Never 7
Daily 1	4-6 days/week 2	2-3 days/week 3					
How often have you felt you weren't able to control the priorities in your life?	75 (18.3)	49 (12.0)	81 (19.8)	77 (18.8)	45 (11.0)	37 (9.0)	45 (11.0)
How often have you felt stressed and anxious?	129 (31.5)	83 (20.3)	75 (18.3)	55 (13.4)	24 (5.9)	25 (6.1)	18 (4.4)
How often have you felt able to deal with your personal struggles?	90 (22.0)	65 (15.9)	74 (18.1)	75 (18.3)	45 (11.0)	33 (8.1)	27 (6.6)
How often have you handled irritating life hassles with success?	75 (18.3)	93 (22.7)	76 (18.6)	76 (18.6)	44 (10.8)	27 (6.6)	18 (4.4)
How often have you felt you were coping successfully with big developments that were occurring in your life?	56 (13.7)	59 (14.4)	71 (17.4)	93 (22.7)	55 (13.4)	44 (10.8)	31 (7.6)
How often have you felt that life was going your way?	43 (10.5)	64 (15.6)	48 (11.7)	66 (16.1)	64 (15.6)	67 (16.4)	57 (13.9)
How often have you felt you were unable to handle all the tasks you had to do?	88 (21.5)	67 (16.4)	67 (16.4)	69 (16.9)	49 (12.0)	36 (8.8)	33 (8.1)

	Number (%)						
	Daily 1	4-6 days/week 2	2-3 days/week 3	Weekly 4	Every other week 5	Monthly 6	Never 7
How often do you find yourself worrying about things that you need to achieve?	185 (45.2)	78 (19.1)	47 (11.5)	53 (13.0)	21 (5.1)	12 (2.9)	13 (3.2)
How often have you felt struggles were adding up so much that you could not handle them?	96 (23.5)	72 (17.6)	64 (15.6)	53 (13.0)	46 (11.2)	41 (10.0)	37 (9.0)
How often have you felt that you were on the ball with tasks you needed to accomplish?	55 (13.4)	67 (16.4)	74 (18.1)	98 (24.0)	51 (12.5)	34 (8.3)	30 (7.3)
How often were you able to control how your time was spent?	64 (15.6)	75 (18.3)	88 (21.5)	76 (18.6)	41 (10.0)	31 (7.6)	34 (8.3)
How often have you become angry due to things that were not in your control?	68 (16.6)	79 (19.3)	62 (15.2)	51 (12.5)	50 (12.2)	46 (11.2)	53 (13.0)

**Table V: Pharmacy students' scores on the perceived stress scale before and during quarantine**

	Paired differences (n=409)				p-value
	Before mean	During mean	Mean change†	SD (95% CI)	
How often have you felt you weren't able to control the priorities in your life?	4.58	3.63	0.944	1.978 (0.752 - 1.136)	< 0.001
How often have you felt stressed and anxious?	3.57	2.78	0.792	1.764 (0.621 - 0.964)	< 0.001
How often have you felt able to deal with your personal struggles?	2.85	3.31	-0.465	1.783 (-0.638 - -0.291)	< 0.001
How often have you handled irritating life hassles with success?	3	3.18	-0.178	1.666 (-0.340 - -0.017)	0.031
How often have you felt you were coping successfully with big developments that were occurring in your life?	3.13	3.7	-0.570	1.701 (-0.735 - -0.404)	< 0.001
How often have you felt that life was going your way?	3.39	4.16	-0.770	1.988 (-0.963 - -0.577)	< 0.001
How often have you felt you were unable to handle all the tasks you had to do?	4.02	3.4	0.619	1.933 (0.431 - 0.806)	< 0.001
How often do you find yourself worrying about things that you need to achieve?	3.08	2.35	0.729	1.629 (0.570 - 0.887)	< 0.001
How often have you felt struggles were adding up so much that you could not handle them?	4.22	3.37	0.846	1.877 (0.664 - 1.028)	< 0.001
How often have you felt that you were on the ball with tasks you needed to accomplish?	3.24	3.6	-0.357	1.824 (-0.534 - -0.180)	< 0.001
How often were you able to control how your time was spent?	2.97	3.45	-0.484	2.092 (-0.687 - -0.281)	< 0.001
How often have you become angry due to things that were not in your control?	4.56	3.7	0.861	1.772 (0.688 - 1.033)	< 0.001

SD: Standard deviation; SEM: standard error of the mean; CI: confidence interval; † Scale: 1=daily, 2=4-6 days/week, 3=2-3 days/week, 4=weekly, 5=every other week, 6=monthly, 7=never

**Discussion**

This study suggests that students had to make substantial adjustments to their method of learning during the transition to virtual learning, with a slight decrease in overall grades as a result. Consistent with the literature, while many pharmacy students had previously

taken online courses in undergraduate studies, the majority preferred in-person instruction (Hamilton *et al.*, 2020). Conversely, other health professionals, such as medical and nursing students, have indicated a preference for and increased satisfaction with asynchronous delivery of content (Schimming, 2008;

Prunuske et al., 2016; Abarghouie, Omid, & Ghadami, 2020). When pontificating on future solutions with the continued surges of variants, it is reasonable to expect that pharmacy curricula across the nation are debating a return to fully in-person, fully remote, or hybrid delivery of pharmacy curricula. This study contributes to the discussion by providing a student pharmacist preference list of courses that may be more conducive to asynchronous methods and the diversity of types of pharmacy learning strategies.

In addition to informing the discussion of student pharmacist preference for delivery of pharmacy curricula, this study also described student pharmacist mental health and well-being during quarantine. While response rate of this study varied greatly between regions, there was at least a 25% prevalence of self-reported history of anxiety across all participating regions. An average of 42.5% of pharmacy students disclosed a baseline history of anxiety. This is consistent with previous literature estimates of up to 57% for anxiety and stress in pharmacy students (Marshall et al., 2008; Beall et al., 2015; Chisholm-Burns et al., 2017; Silva & Figueiredo-Braga, 2018; Garber, Huston, & Breese, 2019; Tak et al., 2019). A recent report from the CDC demonstrated that the largest statistically significant increase in symptoms of anxiety and/or depression between August 2020 and February 2021 was for adults between the ages of 18 and 29 years, and those without a high school education. Approximately 85% of study participants fell into this age cohort. In addition, they found that this age group had the largest increase in unmet mental health needs (Vahratian A, 2021). This is consistent with the results of this study, demonstrating that only about 20% of pharmacy students utilised mental health services despite 62% of pharmacy students feeling isolated and 83% reporting changes in daily activity. Prior to the pandemic, insurance status and income level were the most closely associated predictive factors with the utilisation of clinical preventive services and may inform potential hesitancy to utilise services during quarantine (Song S, 2021).

Importantly, the results of the PSS-10 in this study indicated that pharmacy students across the nation experienced increased levels of stress and their repercussions, such as anger during quarantine. New literature also notes that adults across the nation ages 18 to 44 are reporting increased substance use and suicidal ideations (McKnight-Eily LR, 2021). While historically, there are data suggesting that epidemics and quarantine can contribute to exacerbations of mental health, there are multiple confounders present that may be responsible for these high levels of stress and symptoms of anxiety and/or depression that are not directly related to pharmacy curricula (Pan et al., 2005; X. Liu et al., 2012; Sprang & Silman, 2013; Brooks et al., 2020). A recent

publication in the American Journal of Pharmaceutical Education revealed that the top three priorities for first-year pharmacy students born after 1996 included family, finances, and health (Dresser et al., 2021). In the pandemic setting, all of these factors may have been compromised or challenged, leading to decreases in resilience (Falk G, 2021). While pharmacy students already have a relatively high baseline history of anxiety and depression, the impact of quarantine cannot be overstated.

Given the nature of the study design for this survey study, this study did not identify newly diagnosed conditions or why mental health services were not utilised more during quarantine. It could have been an exacerbation of illness that led to a lack of ability to seek help, or it could have been because in-person help was not available during stay-at-home orders (Demeke HB, 2021). This information is particularly alarming as pharmacy educators hope for vaccination rates that allow for post-pandemic instruction. Post-pandemic, pharmacy schools will not only need to emphasise the importance of self-care, including mental health, but they will also need to prepare preventative steps to address supply with potential increases in demand for mental health services, advocacy, and normalisation of mental health services for a population that often cannot advocate for themselves when they need to the most.

Preparation will be the key as ethical considerations are incorporated into the discussion of student mental health and performance. It is also important to institute and advertise readily available resources for students. Possible means of assistance include incorporating easily employed, positive coping mechanisms such as meditation, mindfulness, or positive reappraisal into curricula or extra-curricular programming (Folkman & Moskowitz, 2000). The process of positive reappraisal includes a cycle of focusing on the positives of a situation and that which has passed (Folkman & Moskowitz, 2000; Garland, Gaylord, & Fredrickson, 2011). Garland and researchers described mindfulness as being "*characterised by an attentive and non-judgmental metacognitive monitoring of moment-by-moment cognition, emotion, perception, and sensation without fixation on thoughts of past and future*" (Garland et al., 2011). Literature has shown that focusing on mindfulness can significantly reduce stress (Grossman et al., 2004; Baer et al., 2006; Chiesa & Serretti, 2009; Garland et al., 2011). Colleges of pharmacy can help by providing both training in these practices as well as provisions of a wellness space for students (I. Liu et al., 2020).

The main limitation of this study was that the dataset of this study contains a total of 488 participants, which is small compared to typical datasets from the field. There

was a low response rate across all colleges of pharmacy in the United States (24 of 144 contacted pharmacy programmes). Despite this, the total number of student survey responses was close to 500, which is a substantial amount compared to other literature on this topic. Other recently published literature evaluating COVID-19 transitions on pharmacy students' well-being has had sample sizes of around 100, indicating that despite this study's response rate, the results from a sample size this large are of interest in the literature (Hagemeier & Dowling-McClay, 2021). This study was also able to identify the following themes from programmes that declined to participate: student survey fatigue, IRB requirements that a local faculty member is listed on the IRB, unusually high faculty workloads, and when managing acute needs of faculty and students, the delivery of the curriculum was a higher priority. Another limitation to this study is that it is a survey, which can only show a correlation and not causation. It is unclear if quarantine caused the increase in student pharmacist stress, the change in learning, or other more intimate matters such as family, health, and/or finances. Additional areas for future research include strategies to increase regular maintenance and acute usage of mental health services and institutional investigations into additional support that can be provided to pharmacy students as the world begins plans for transitions to normal, or at the least a normal, with periodic surges.

## Conclusion

Pharmacy students struggled with the transition to virtual delivery of pharmacy curricula and had increases in several risk factors for mental health illness during the pandemic. However, future considerations for pharmacy schools would be to include a hybrid model of in-person and online content to cater to student variety in learning styles and preferences. This could be based on the type of courses as indicated by Table III or delivering content in multiple, interactive formats and team-building activities to help students feel connected. Additionally, it is imperative that pharmacy schools address high baseline and exacerbated rates of anxiety and depression among pharmacy students.

## Conflict of interest

No authors have any financial disclosures or conflicts of interest.

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