Article

Self-Reported Depression and Anxiety among Graduate Students during the COVID-19 Pandemic: Examining Risk and Protective Factors

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Abstract: Depression and anxiety among students in higher education are well-established public health concerns with rates that have steadily increased over the past several decades. The global COVID-19 pandemic caused a need for rapid transition on campuses to online learning, a disruption of research, and uncertainty about meeting program requirements and employment. Graduate students often feel overlooked at the best of times and the potential for the pandemic to worsen this perception cannot be understated. This study examined the rates of self-reported depressive and anxiety symptoms among graduate students who were located at the national epicenter of the COVID-19 pandemic in the United States in the spring of 2020. Demographic characteristics, loneliness, and coping to determine potential risk and protective factors were also examined. A comprehensive online survey was created including the University of California Los Angeles (UCLA) 3-Item Loneliness Scale, the Patient Health Questionnaire Depression Scale (PHQ-9), and the Generalized Anxiety Disorder scale (GAD-7). Descriptive statistics, Pearson's chi-squared test, Spearman's correlation, and unadjusted and adjusted multivariable logistic ordinal regression models were used to describe the sample and to assess factors associated with depression and anxiety. 341 surveys were analyzed; respondents had a mean age of 31.88, 68% were female, 63% were White, and 23% identified as lesbian/gay/bisexual. Approximately 89% of students reported moderate-severe depression, and 76% moderate-severe anxiety. Risk factors associated with depression ($p < 0.05$) were being "sometimes' lonely", "often/always lonely", and time spent searching COVID-19 information. Emotional support, having children, and perceived emotional/mental health were protective against depression ($p < 0.05$). Risk factors associated with anxiety were "'often/always lonely", identifying as lesbian/gay/bisexual, and time searching COVID-19 information. Coping, having children, being born outside of the U.S., and perceived emotional/mental health were protective against anxiety ($p < 0.05$). Based on study findings, it is recommended that universities include more focused interventions for graduate students in consideration of their unique personal and professional needs. Graduate students are part of the emerging professional workforce and as such employers are also advised to integrate wellness and mental health programs and interventions into their employee assistance programs.

Keywords: mental health; anxiety; depression; graduate students; higher education; COVID-19

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1. Introduction

The mental health of students involved in higher education has been gaining attention as research into high rates of anxiety, depression, and suicide becomes more robust. The Association for University and College Counseling Center Directors published a report in 2012 stating that anxiety was the most salient issue for college students with 41.6% of the students they served reporting symptoms. Other common concerns include depression (36.4%) and suicidal ideation (16.1%) [1]. Within the general college student population, the

American College Health Association found that 36.7% of students experienced depression and 58.4% experienced anxiety [2]. There is also evidence that these rates have been on the rise in the last few decades. Researchers collected data from Chinese college students over a 17-year period (2000–2017) and found scores from the Self-Rating Depression scale increased around 6 points during that time [3]. The Healthy Minds Study (HMS), an annual survey of 373 campuses conducted in the U.S., reported that in the 2020–2021 academic year that over 60% of students surveyed met criteria for at least one or more mental health problems [4], which can indicate that the issues brought on by COVID-19 worsened college student mental health [5]. The HMS report also indicated that this finding was a 50% increase since 2013 [4]. Similar results were found in another study, stating that 7.9% of the students met the criteria for major depressive disorder (MDD) and 17.5% met the criteria for Generalized Anxiety Disorder (GAD) [6].

However, undergraduate students are often overrepresented in the populations used for research. Graduate student data most often appear in conjunction with undergraduate students with only a handful focusing on that population specifically. In the United States in 2020, 19.4 million students attended post-secondary school and 3.1 million of them were graduate students [7]. While graduate students were found to have lower rates of anxiety and depression [6,8,9], the makeup of the population is different and therefore their risk factors are as well. Another American College Health Association [10] report states that 70% of graduate students are older than 25, 21.5% are international students, 68.5% are single, 48.3% are on their school's health insurance plan, and 73.1% are in off-campus housing. Graduate students are also six times more likely to have a mental health issue than the general population [11], indicating an existing student problem prior to the pandemic. Graduate students' work may consist of being responsible for undergraduate teaching assistants, conducting research of their own, or assisting a professor with research, further demonstrating the need for graduate students to care for and mentor others in the campus community [12].

The distinction between graduate and undergraduate students is important but it is especially salient when researching the effects of the global pandemic students have endured over the last three years. Women [13,14] and people who are single [15] were found to have the highest levels of psychological distress during the pandemic. Like undergraduate programs, women make up more than half of graduate students [16] and as discussed above, most students are also single [10]. While many students work within the institution, if graduate students do need other work, they often require flexible-schedule jobs such as in retail or restaurant and hospitality industries, which is employment that puts students in high-risk areas for contracting COVID-19. Graduate students are also at different developmental stages and milestones that can cause additional stressors, such as having spouses and children, intimate partner violence, divorce, and competing financial needs. Major events, such as COVID-19, can result in further and major disruptions and upheaval in the lives of graduate students.

Many graduate students existed in an interesting intersection of both student and teacher while navigating the many changes during the pandemic. Whether that be through teaching classes themselves or being a teacher's assistant, they experienced the additional burden of navigating both sides of the educational upheaval when programs were forced to go remote. The quality of education is largely reliant on two factors: the curriculum and those who are teaching that curriculum [17,18]. Both areas required reformatting for the new educational landscape online. Additionally, there are internal (knowledgeability of the teacher) and external factors that influence how well a teacher teaches. Teachers of science, technology, engineering, and mathematics (STEM) subjects in the United Arab Emirates (UAE) reported that external factors posed a greater challenge than internal factors [19]. A study of mathematics teachers in the Qassim Education Department reported that while aspects of teaching such as planning, teaching new concepts, evaluation, class management, and engagement were being implemented at a high-level post-shift to online education, variables like diversifying the manner in which responses were received for

activities required additional work [17]. These new challenges often fell on graduate students to navigate themselves as both student and teacher. Most notably, differently from undergraduates, many graduate students state that they do not feel supported by their department or institutions [12,20]. Graduate students have reported that their degree has been prolonged due to the pandemic, [12,20,21] which can in turn affect their healthcare coverage and other support networks. Closure of school campuses also restricted graduate students' access to food, housing, and research materials, which in turn influences when they are able to finish their research and subsequently their degree [20].

Loneliness may further be a common experience among graduate students. Pursuing a graduate degree can be an isolating experience, as students may spend long hours working alone in libraries or labs, with limited social interaction. Many graduate students also move to new cities or countries for their studies, leaving behind family and friends, which can further exacerbate feelings of loneliness [22]. Additionally, the pressure to excel in their studies can be intense, leading to feelings of inadequacy and self-doubt that can contribute to a sense of isolation and disconnection. Moreover, the pandemic worsened the issue of loneliness for graduate students, as many universities shifted to remote learning and social-distancing measures were put in place. The lack of in-person interaction with peers and mentors can lead to students feeling disconnected and unsupported, negatively impacting their mental health [9,23]. The absence of social events, such as conferences or departmental gatherings, can also limit opportunities for networking and building relationships with fellow students, which are important for their academic and professional development. In addition, graduate students were vital during the initial response to the COVID pandemic, particularly those in the health and social services fields. As part of the emerging professional workforce, graduate students were called to respond in supporting health and social services first responders in spite of their partial training, further causing strains on physical and mental health [24–26].

Support structures for mental health on university campuses are critical for ensuring the wellbeing of students. Many universities have mental health centers that provide counseling services, therapy, and support groups for students. These services are typically free or low-cost and they offer a safe space for students to discuss their mental health concerns with trained professionals [27]. In addition to individual counseling, many universities also offer group therapy sessions and workshops on topics such as stress management, mindfulness, and coping skills. These resources can be particularly beneficial for students who may be struggling with anxiety, depression, or other mental health issues. The degree to which students feel supported on campus in regards to their mental health may vary depending on a variety of factors such as the availability of resources, cultural norms, individual experiences, and the specific institution. However, research suggests that many students do not feel adequately supported when it comes to mental health on campus. For example, a national survey conducted by the American College Health Association found that in 2020, 63.4% of students felt "very good" or "good" about their campus mental health services while 36.6% felt "fair", "poor", or "very poor" about these services. In addition, a 2020 survey of undergraduate students in the United States found that nearly 60% of respondents believed that their institution did not provide enough mental health support [4]. Furthermore, various studies have identified barriers that students face when seeking mental health support on campus, including long wait times for appointments, lack of access to specialized care, and stigma surrounding mental health concerns [28]. These barriers can discourage students from seeking help and may contribute to feelings of isolation and frustration. Overall, while many universities offer mental health resources and support structures, more work is needed to ensure that these resources are accessible, effective, and tailored to the needs of diverse student populations [29].

1.1. The Current Study

As more and more people are obtaining their vaccines and with waves of COVID-19 infections with new variants, it is time to look back and note the consequences of the

pandemic on vulnerable populations, such as graduate students, in order to better prepare for what is required for immediate recovery and future crisis. The pandemic has already been shown to have caused high rates of anxiety and depression in the general population [13,14,30–32] as well as university students in general [33,34]. Graduate students, in particular, have their own unique challenges and occupy a specific transitional period in life that makes them an important research population to focus on. The current study addresses this gap in research on better understanding the mental health experiences of graduate students during the pandemic and focuses on the following two research questions: (1) How was the COVID-19 pandemic associated with the mental health of graduate students in the United States specific to experiences of depression and anxiety? and (2) What were the risk and protective factors for graduate students experiencing depression and anxiety during the pandemic? The objectives of this study were to examine the rates, risks, and protective factors of depression and anxiety among graduate students during the COVID-19 pandemic. In the following sections, the theoretical framework informing the objectives and study purpose, methodology, results, and discussion are reviewed.

1.2. Theoretical Framework

A social determinants determinance view of mental health can be utilized to understand the many facets that impact mental health outcomes, specifically for students in institutions of higher education. The social determinants of mental health perspective "emphasizes not only individual factors including genes, personality, age, and social identities that are associated with wellbeing but also factors within the environment such as the provision of basic needs, availability of support and quality of relationships [35,36]". In this context specifically, the mental health impact of COVID-19 could be either buffered by or worsened by social support, loneliness, perceived health, direct impact of COVID-19, and personal factors. Intersectionality theory holds that systems of oppression work to marginalize individuals along multiple dimensions of identity [37]. Therefore, students can experience the COVID-19 pandemic differently based on their multiple and intersecting identities, which may each have unique stressors associated with them.

2. Materials and Methods

The study sample included 401 participants who were surveyed using Qualtrics software (Qualtrics, Provo, UT, USA). Students were recruited from the Schools of Social Welfare, Nursing, Health Technology and Management and the Graduate School at Stony Brook University. This study was approved by the Stony Brook University (IRB2020-00347) institutional review board.

2.1. Recruitment and Sampling

Eligibility criteria for graduate students to participate in the study included: (1) being over the age of 18 years old, (2) enrolled as a graduate student at Stony Brook University during the 2019–2020 academic year, and (3) students' consent to respond to the survey. The survey was disseminated from 22 June–23 August of 2020. Recruitment occurred through posting study fliers to departmental social media channels and emails sent to graduate students using departmental listservs. Participation was voluntary and anonymous. All participants received information about COVID-19 safety precautions and mental health resources at the end of the survey.

2.2. Measures

Outcome Variables

The severity of depression symptoms was measured by the validated and reliable Patient Health Questionnaire (PHQ)-9 [38]. Responses are scored from 0 to 27 and standard cut-offs were used to determine the severity of symptoms based on three categories: minimal to no symptoms (score < 10), moderate symptoms (scores 10–14), and 3), and moderate to severe symptoms (scores $\geq$ 15) [38]. PHQ-9 scores > 10 had a sensitivity of 88% and

a specificity of 88% for major depressive disorder. The reliability and validity of the tool have indicated that it has sound psychometric properties and the internal consistency of the PHQ-9 has been shown to be high [39]. Reliability tests have found a Cronbach's alpha of 0.89 among primary care patients, 0.86 among OB-GYN patients, and 0.892 in patients with major depressive disorder in a psychiatric hospital [38,40]. The Generalized Anxiety Disorder (GAD)-7 scale was used to measure students' anxiety severity. The standard cut-offs for this validated and reliable survey tool were used for severity of symptoms to create three outcome categories for anxiety symptoms: minimal to mild anxiety (<9), moderate symptoms (10–14), and severe symptoms (≥15) [41]. The reliability coefficient Cronbach's α for the overall GAD-7 scale is 0.89 in the general population, which is greater than the recommended value of 0.80, suggesting excellent reliability [41].

2.3. Independent Variables

Loneliness experienced in the past three months was measured using the UCLA 3-Item Loneliness Scale with scores ranging from 3 to 9 (higher scores indicate greater loneliness) [42]. The following categories were assigned: "never lonely" (score of 3), "sometimes lonely" (scores 4 to 6), and "often or always lonely" (scores 7 to 9) [43]. Other independent variables were perceived mental health ("At the present time would you say your mental and emotional health is: poor, fair, good, very good, excellent"), perceived physical health ("At the present time would you say your physical health is: poor, fair, good, very good, or excellent"), emotional support ("How much emotional support do you receive from your surroundings (e.g., friends, online friends, parents, significant others, family members)? 1 (no support) to 10 (a lot of support)"), mental health treatment in past 3 months ("yes/no"), and coping ("On a scale of 1 to 10, where 1 is "not coping well at all" and 10 is "coping extremely well", please rate how you feel you are coping with the COVID-19 pandemic").

The following five variables were created to assess the impact of COVID-19 and included the following: (1) having family or close friends test positive to COVID-19 ("Have any immediate family members or close friends tested positive for COVID-19?") with responses including: no, yes one person, yes more than one person; (2) having family/friends that died from COVID-19 ("Have any immediate family members or close friends died from COVID-19?) with responses including: no, yes-one person, yes —more than one person (3) time searching COVID-19 news ("How often do you search for information about COVID-19 news and developments (e.g., read websites, use apps that are continually updated, listen to radio/TV)?") with responses including: "never or almost never", "a few times a month", "a few times a week", "once a day", "a few times a day", and "I try to stay updated all of the time", (4) feeling increased pressure to be productive ("Please indicate how much you agree or disagree with the following statement: "I feel increased pressure to be productive (e.g., classes, employment, research) due to COVID-19" with responses ranging from "strongly agree" to "strongly disagree", and (5) inability to pay rent/mortgage ("In the last month, did any of the following occur?: You could not pay full rent or mortgage because you could not afford to") with responses including: "no", "did not happen", "yes, due to COVID-19", and "yes, but unrelated to COVID-19". For our analysis, the responses to the mortgage/rent question were transformed to Yes ("due to COVID-19") and No ("did not happen" and "yes, but unrelated to COVID-19").

2.4. Sociodemographic Factors

The following sociodemographic variables were collected as potential factors associated with an outcome or as potential confounders: age, sex assigned at birth, gender expression, race/ethnicity, degree program type (e.g., Master of Social Work, PhD), annual household income, marital status, children status/number, and sexual orientation.

Statistical Analysis

Descriptive statistics, Pearson's chi-squared test, Spearman's correlation, and unadjusted and adjusted multivariable logistic ordinal regression models were used to describe the sample and to assess factors associated with depression and anxiety. Significant findings in the unadjusted logistic regressions were retained for the adjusted multivariable models as well as certain demographic factors even if the unadjusted logistic regression was not significant for each respective outcome. Odds ratios (OR) and 95% confidence intervals (CI) were produced. The same variables were used in the regression models for depression and anxiety. All analyses were conducted in SPSS version 28.0.

3. Results

A total of 401 students responded to the survey. Using an 80% survey completion cut-off rate, 341 responses were analyzed. Graduate students had a mean age of 31.88 (SD 10.00). Students were 68% female, 63% White, 13% Hispanic, 25% married, 30% born outside of the U.S., and 22% identified as gay/lesbian/bisexual (LGB). Figure 1 shows the self-reported severity of depression and anxiety symptoms among graduate students with 89.1% reporting moderate to severe depression and 29.9% reporting severe depression. Approximately 75% of students reported moderate to severe anxiety and 39.9% reported severe anxiety. Of the respondents, 54% percent reported feeling sometimes lonely and 27.3% reported feeling often or always lonely. Figure 2 shows that 40% of students perceived their mental health as poor or fair whereas 6.5% of students perceived their physical health as poor or fair. At the time of the survey, nearly 40% of students knew someone close to them with COVID-19 and 9% had someone close to them die of COVID-19. Over 60% of graduate students reported feeling increased pressure to be productive during the pandemic and 1 in 12 students had difficulty paying their rent or mortgage as a result of the COVID-19 pandemic. See Table 1 for additional sample description.

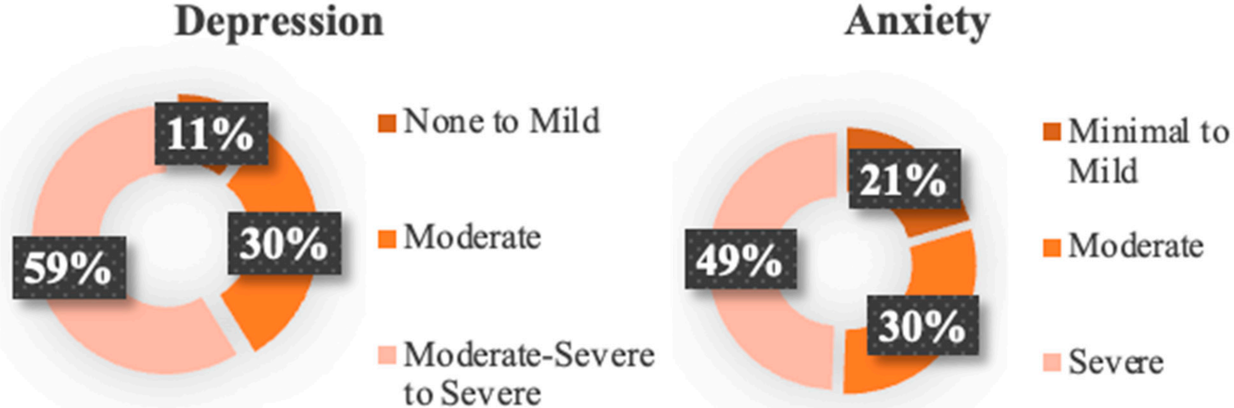

Figure 1. Severity of Depression and Anxiety Symptoms.

3.1. Depression

As shown in Table 2, students who reported being sometimes lonely (OR = 2.83, 95% CI = 1.32, 6.03), being often or always lonely s (OR = 6.33, 95% CI = 2.17, 18.47), that they could not fully pay their mortgage/rent (OR = 7.98, 95% CI = 1.11, 57.36), or that they spent more time searching for COVID-19 news/information (OR = 1.28, (95% CI = 1.01, 1.62) had a significantly increased risk of having more severe depression symptoms. Students with better perceived mental health (OR = 0.52, 95% CI = 0.36, 0.76) and those with children (OR = 0.30, 95% CI = 0.10, 0.93) were associated with experiencing significantly less severe depression symptoms.

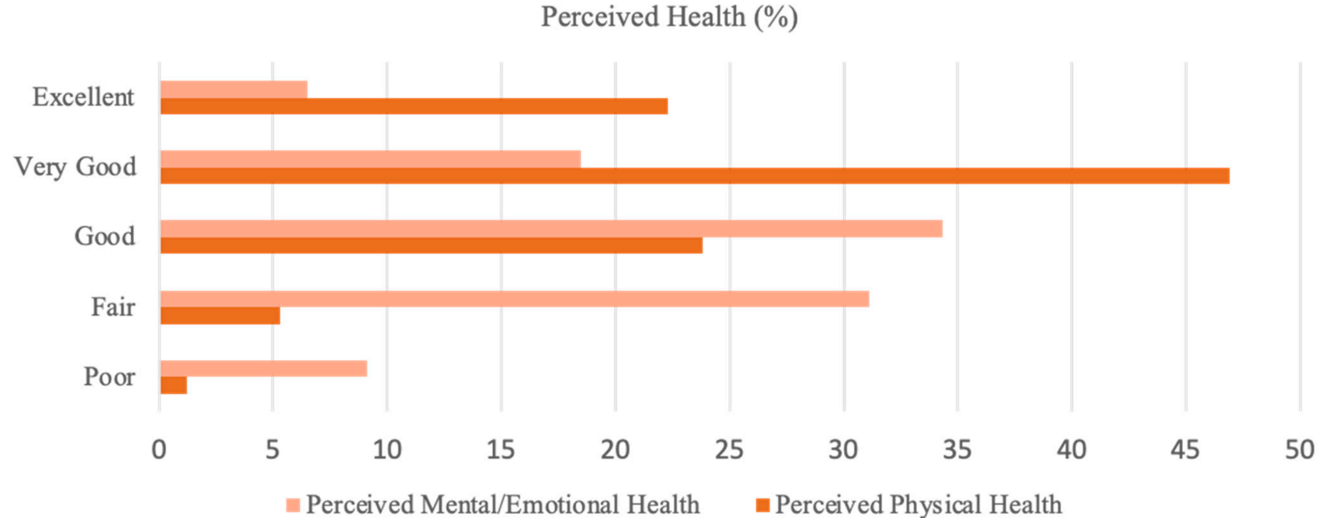

Figure 2. Perceived Mental/Emotional Health and Perceived Physical Health.

Table 1. Demographics.

Variable	**N**	**%**	**Mean (SD)**
Age (years)			31.88 (10.00)
Gender			
Male	91	26.7	
Female	233	68.3	
Non-binary/third gender	11	3.2	
Not specified	6	1.8	
Race			
White	216	63.3	
Black	21	6.2	
Asian	66	19.4	
Multiracial/biracial	12	3.5	
Other	11	3.2	
Not specified	15	4.4	
Hispanic			
No	289	84.8	
Yes	44	12.9	
Unspecified	8	2.3	
Sexual orientation			
Heterosexual	248	77.3	
Identifies as gay/lesbian/bisexual	73	22.7	
Not specified	20	5.9	
Transgender			
No	325	95.3	
Yes	10	2.9	
Not specified	6	1.8	

Table 1. *Cont.*

Variable	N	%	Mean (SD)
Marital status			
Single, never married	234	68.6	
Married/living common-law	86	25.2	
Widowed/divorced/separated	21	6.2	
Children			
No	266	78.0	
Yes	74	21.7	
Not specified	1	0.3	
Country of birth			
United States	232	74.9	
Other	102	29.9	
Not specified	7	2.1	
Household income			
<$20,000	52	15.2	
$20,000 to $39,999	85	24.9	
$40,000 to $59,999	37	10.9	
$60,000 to $79,999	43	12.6	
$80,000 to $99,999	34	10.0	
>$100,000	84	24.6	
Not specified	6	1.8	
Coping, scale of 1–10 (not coping to coping well)			6.15 (2.17)
Emotional support, scale of 1–10 (none to a lot)			7.62 (2.19)
Physical health, perceived			
Poor	4	1.2	
Fair	18	5.3	
Good	81	23.9	
Very good	160	46.9	
Excellent	76	22.3	
Not specified	2	0.6	
Mental/emotional health, perceived			
Poor	31	9.1	
Fair	106	31.3	
Good	117	34.5	
Very good	63	18.6	
Excellent	22	6.5	
Not specified	2	0.6	
Loneliness			
Never lonely	63	18.5	

Table 1. *Cont.*

Variable	N	%	Mean (SD)
Sometimes lonely	184	54.1	
Often or always lonely	93	27.4	
Not specified	1	0.3	
Increased pressure to be productive due to COVID-19			
Strongly disagree	20	5.9	
Disagree	26	7.6	
Neither agree or disagree	75	22.0	
Agree	135	39.6	
Strongly agree	78	22.9	
Not specified	7	2.1	
Inability to pay full rent/mortgage, previous 3 months			
No	312	91.5	
Yes	27	7.9	
Not specified	2	0.6	
Close family/friend test positive for COVID-19			
No	206	60.4	
Yes, one person	44	12.9	
Yes, more than 1	90	26.4	
Not specified	1	0.3	
Close family/friend die from COVID-19			
No	309	90.6	
Yes, one person	16	4.7	
Yes, more than one	15	4.4	
Not specified	1	0.3	
Time spent searching for COVID-19 information			
Never or almost never	21	6.2	
A few times a month	49	14.4	
A few times a week	112	32.8	
Once a day	84	24.6	
A few times a day	43	12.6	
I try to stay updated all the time	31	9.1	
Not specified	1	0.3	

3.2. Anxiety

As described in Table 3, students who reported often or always experiencing loneliness during the past three months (OR = 3.65, 95% CI = 1.43, 9.34), spent more time searching for COVID-19 news/information (OR = 1.26, 95% CI = 1.02, 1.57), and those that identify as LGB (OR = 2.33, 95% CI = 1.16, 4.67) had significantly more severe anxiety symptoms. Students who reported greater coping (OR = 0.78, 95% CI = 0.66, 0.92), perceived their mental/emotional health as better (OR = 0.41, 95% CI = 0.29, 0.59), were born outside the U.S. (OR = 0.34, 95% CI = 0.16, 0.72), and who had children (OR = 0.33, 95% CI = 0.12, 0.94)

were significantly more likely to experience less severe anxiety symptoms. Knowing a close family member or friend who had COVID-19 or died from COVID-19 was not significantly associated with students' depression or anxiety symptoms.

Table 2. Depression Ordinal Logistic Regression Model.

Variable	Unadjusted		Adjusted	
	OR	**CI**	**OR**	**CI**
Age	0.95 ***	0.93, 0.97	1.00	0.96, 1.04
Gender				
Male	ref		ref	
Female	0.90	0.56, 1.46	0.57	0.28, 1.14
Non-binary	6.92	0.85, 56.20	4.41	0.24, 81.64
Race				
White	ref		ref	
Black	0.69	0.29, 1.65	0.52	0.12, 2.24
Asian	0.95	0.55, 1.64	1.02	0.40, 2.60
Multi/biracial	3.26	0.70, 15.26	2.72	0.39, 19.20
Other	1.21	0.35, 4.15	0.91	0.16, 5.08
Hispanic	0.98	0.52, 1.84	0.88	0.30, 2.62
Identifies as LGB	1.92 *	1.12, 3.30	1.60	0.73, 3.48
Transgender	1.23	0.36, 4.12	0.35	0.04, 2.74
Marital Status				
Single, never married	ref		ref	
Married/common-law	0.42 ***	0.26, 0.69	1.36	0.50, 3.70
Divorced/widowed/separated	0.43 ***	0.17, 1.07	0.99	0.16, 6.00
Has children	0.32 ***	0.19, 0.52	0.30 *	0.10, 0.93
Born outside the U.S.	1.01	0.64, 1.61	1.50	0.66, 3.40
Household income	0.74	0.66, 0.84	0.95	0.78, 1.15
Loneliness				
Never lonely	ref		ref	
Sometimes lonely	5.78 ***	3.20, 10.44	2.83 **	1.32, 6.03
Often or always lonely	23.71	10.88, 51.64	6.33 ***	2.17, 18.47
Coping	0.61 ***	0.54, 0.69	0.84	0.70, 1.02
Emotional support	0.77 ***	0.69, 0.85	0.84 *	0.72, 0.99
Physical health, perceived	0.50 ***	0.38, 0.66	0.69	0.46, 1.02
Mental/emotional health, perceived	0.30 ***	0.23, 0.39	0.52 ***	0.36, 0.76
Someone close test positive COVID	0.93	0.73, 1.18	0.89	0.61, 1.28
Someone close died from COVID	1.19	0.74, 1.92	1.42	0.70, 2.88
Time searching for COVID-19 info	1.37 ***	1.15, 1.62	1.28 *	1.01, 1.62
Pressure to be productive	0.58 ***	0.48, 0.72	1.13	0.86, 1.49
Inability to pay mortgage/rent	2.18	0.91, 5.26	7.98 *	1.11, 57.36

Note. CI = confidence interval; OR = odds ratio. *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

Table 3. Anxiety Ordinal Logistic Regression Model.

Variable	Unadjusted		Adjusted	
	OR	**CI**	**OR**	**CI**
Age	0.95	0.93, 0.97	0.99	0.95, 1.03
Gender				
Male	ref		ref	
Female	1.03	0.66, 1.62	0.77	0.42, 1.42
Non-binary	2.88	0.82, 10.16	3.21	0.23, 45.67
Race				
White	ref		Ref	
Black	0.80	0.35, 1.86	1.25	0.33, 4.78
Asian	0.73	0.44, 1.21	1.25	0.53, 2.95
Multi/biracial	1.86	0.59, 5.88	1.11	0.24, 5.14
Other	0.79	0.26, 2.43	1.01	0.21, 4.90
Hispanic	0.96	0.52, 1.75	1.06	0.40, 2.78
Identifies as LGB	2.44 ***	1.49, 4.01	2.33 *	1.16, 4.67
Transgender	1.09	0.35, 3.44	0.25	0.04, 1.73
Marital status				
Single, never married	ref		ref	
Married/common-law	0.47 ***	0.29, 0.75	2.24	0.88, 5.70
Divorced/widowed/separated	0.49	0.21, 1.15	2.97	0.58, 15.29
Has children	0.35 ***	0.22, 0.58	0.33 *	0.12, 0.94
Born outside the U.S.	0.68	0.44, 1.04	0.34 **	0.16, 0.72
Household income	0.77 ***	0.69, 0.86	0.88	0.73, 1.04
Loneliness				
Never lonely	ref		ref	
Sometimes lonely	3.92 ***	2.23, 6.87	1.77	0.84, 3.72
Often or always lonely	13.45 ***	6.92, 26.15	3.65 **	1.43, 9.34
Coping	0.57 ***	0.50, 0.64	0.78 **	0.66, 0.92
Emotional support	0.81 ***	0.74, 0.90	0.96	0.84, 1.10
Physical health, perceived	0.55 ***	0.43, 0.71	0.94	0.67, 1.31
Mental/emotional health, perceived	0.25 ***	0.19, 0.32	0.41 ***	0.29, 0.59
Someone close test positive COVID	1.00	0.80, 1.26	0.97	0.70, 1.36
Someone close died from COVID	0.96	0.63, 1.47	0.90	0.47, 1.70
Time searching for COVID-19 info	1.38 ***	1.18, 1.62	1.26 *	1.02, 1.57
Increased pressure to be productive	1.85 ***	1.51, 2.26	1.18	0.91, 1.52
Inability to pay mortgage/rent	2.01	0.94, 4.31	2.17	0.60, 7.86

Note. CI = confidence interval; OR = odds ratio. *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

4. Discussion

Overall, approximately 89% of students reported moderate-severe depression and 76% of students reported moderate-severe anxiety. Risk factors associated with graduate students experiencing depression symptom included feeling “sometimes lonely”, “often/always” lonely, and spending time searching for COVID-19 information. Emotional

support, having children, and perceived emotional/mental health were protective against depression. Risk factors associated with anxiety were "often/always lonely", identifying as lesbian/gay/bisexual, and time searching for COVID-19 information. Coping, having children, being born outside of the U.S., and perceived emotional/mental health were protective against anxiety. Data from this research demonstrate high rates of moderate to severe depression and anxiety in graduate student populations, a population that is often overlooked in research and by student support services. Consistent with prior research, we found that coping had a strong negative association with depression and anxiety while loneliness had a strong positive correlation [44,45]. As such, more interventions are needed for graduate students to address loneliness and to improve coping skills in order to improve overall mental health outcomes. Social resources, such as social support, relationships, and social connectedness, can have a significant impact on mental health outcomes such as loneliness, anxiety, and depression and as such should be public health areas of focus. This idea was demonstrated in the current study by graduate students with children and with higher levels of emotional support reporting less depression and anxiety symptoms. Research has additionally shown that individuals who have strong social networks and support systems are less likely to experience negative mental health outcomes, while those who lack social resources are more likely to experience them, and has been confirmed with this study [44].

Anxiety and depression are among the most prevalent mental health disorders in the United States. According to the National Institute of Mental Health (NIMH), in 2020, approximately 19.1% of adults in the U.S. experienced some form of anxiety disorder in the past year while 7.8% of adults experienced a major depressive episode [46]. The COVID-19 pandemic has put an additional strain on people around the world, given that the spread of the virus was not limited by geographical boundaries, and included physical health, mental health, economic, and educational impacts [47]. Additionally, the pandemic had a profound impact on mental health outcomes, including demonstrated increases in depression and anxiety. A 2020 survey conducted by the Centers for Disease Control and Prevention (CDC) found that the percentage of adults with symptoms of an anxiety or depressive disorder increased from 36.4% to 41.5% from August 2020 to February 2021, indicating the major negative impact of the pandemic on mental health in the general population [48]. These findings extend to the graduate student population, who often experience additional hardships related to financial strain, caring for dependents, and academic and professional stressors, which were exacerbated by the pandemic [49,50].

4.1. Implications for Higher Education Research and Practice

Support structures for mental health on university campuses are critical for ensuring the wellbeing of students. Many universities have mental health centers that provide counseling services, therapy, and support groups for students, yet are often underutilized. These services are typically free or low-cost, and they offer a safe space for students to discuss their mental health concerns with trained professionals. In addition to individual counseling, many universities also offer group therapy sessions and workshops on topics such as stress management, mindfulness, and coping skills. These resources can be particularly beneficial for students who may be struggling with anxiety, depression, or other mental health issues. The degree to which students feel supported on campus in regard to their mental health may vary depending on a variety of factors such as the availability of resources, cultural norms, individual experiences, and the specific institution. However, research suggests that many students do not feel adequately supported when it comes to mental health on campus [9]. For example, a national survey conducted by the American College Health Association found that in 2020, 63.4% of students felt "very good" or "good" about their campus mental health services while 36.6% felt "fair," "poor", or "very poor" about these services. In addition, a 2020 survey of undergraduate students in the U.S. found that nearly 60% of respondents believed that their institution did not provide enough mental health support [4]. Furthermore, various studies have identified barriers

that students face when seeking mental health support on campus, including long wait times for appointments, lack of access to specialized care, and stigma surrounding mental health concerns [50]. These barriers can discourage students from seeking help and may contribute to feelings of isolation and frustration. COVID-19 placed additional strains on students and on educational systems with the rapid move from in-person learning to online learning. Students often lacked the necessary technology for online learning and required university support to ensure adequate equipment and learning needs; although students spent more time per day studying, they achieved lower academic achievement [51]. This study confirmed findings that students' physical and mental health were affected by the stressors of COVID-19 and were further impacted by intersecting identities related to race, gender, and geographic location [52,53]. As such, it is imperative for universities and future employers to understand and address the needs of students to ensure academic and social success. Studies have demonstrated that greater engagement with instructors and peers through means such as social media and collaborative learning environments can have a positive impact on wellbeing and demonstrate the importance of creating sustainable systems in education [54]. Overall, while many universities offer mental health resources and support structures, more work is needed to ensure that these resources are accessible, effective, sustainable, and tailored to the needs of diverse student populations.

Limitations

Our study is unique in its focus on the lived experiences of a diverse group of graduate students majoring in a variety of degree programs. With much of the literature on university or college settings focusing on the undergraduate population, our study considers the mental health and wellbeing of a special population of students who are engaging in additional years of education in the hopes of advancing their professional goals. Our findings reveal that graduate students were in a particularly precarious situation during the pandemic as they often occupy a variety of adult roles (e.g., working, caregiving) in addition to managing their roles in academia (e.g., student, research assistant, teaching assistant). However, this study is not without limitations. The cross-sectional graduate student sample can only provide a brief examination into student experiences and attitudes during the beginning of the pandemic in 2020. Therefore, we are unsure what students' mental health, including their depression and anxiety symptomatology, was prior to the start of the pandemic. Although our sample included over 400 students across various degree programs, the study sample and findings may not be generalizable across all degree programs or universities. Future research should consider longitudinal data collection on the long-term impact of the pandemic on graduate students' academic, professional, and personal outcomes in order to best improve upon the supports most utilized by graduate student populations.

5. Conclusions

The COVID-19 pandemic has had a profound impact on mental health globally and college students are no exception. The sudden shift to online learning, social isolation, and financial difficulties have created new challenges for students that can negatively impact their mental wellbeing. Graduate students are at a critical stage of their lives with significant changes occurring in their physical, psychological, professional, and social development. During this time, they are often faced with numerous stressors that can affect their mental health. The COVID-19 pandemic has added to these existing stressors, creating an even more challenging environment for students. As such, it is imperative that universities provide varying evidence-based interventions and programming to support the physical and mental health needs of students.

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