Investigating College Students' Mental Health During the COVID-19 Pandemic: An Online Survey Study

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Abstract

Background: Evidence suggest that COVID-19 pandemic has caused increased levels of stress and depression among the public. However, the impact on college students in United States has not been documented.

Objective: This article reports findings of an online survey regarding mental health conditions of college students in a large university in the United States during COVID-19.

Methods: An online survey was conducted among participants recruited from a large university system in Texas, United States, to assess the mental health of students during the pandemic. The survey mainly consists of two standardized scales for depression and anxiety, as well as questions regarding stressors and coping mechanisms specific to the COVID-19.

Results: Among the 2031 participants, 80.57% showed some moderate to severe level of depression, 71.75% showed mild to severe level of anxiety, and 18.04% of participants had suicidal thoughts. A majority of participants (71.26%) indicated that their stress/anxiety levels had increased during the pandemic. Less than half (43.25%) of the participants indicated that they were able to cope adequately with the stress related to the current situation.

Conclusions: The proportion of respondents showing depression, anxiety and/or suicidal thoughts is alarming. Respondents reported academic, health, and lifestyle-related concerns caused by the pandemic. Given the unexpected length and severity of the pandemic, these concerns need to be further understood and addressed.

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Investigating College Students' Mental Health During the COVID-19 Pandemic: An Online Survey Study

Abstract

Background: Evidence suggests the COVID-19 pandemic has caused increased levels of stress and depression among the public. However, the impact on college students in the United States has not been well-documented.

Objective: This article surveys the mental health status and severity of depression and anxiety of college students in a large university system in the United States during COVID-19.

Method: An online survey was conducted among participants recruited from Texas A&M University via email, at all levels of study from undergraduate and graduate schools. The survey consists of two standardized scales, Patient Health Questionnaire-9 and General Anxiety Disorder-7, for depression and anxiety, and additional multiple choice and open-ended questions regarding stressors and coping mechanisms specific to the COVID-19.

Results: Among the 2031 participants, 48.14% showed moderate to severe level of depression, 38.48% showed moderate to severe level of anxiety, and 18.04% of participants had suicidal thoughts. A majority of participants (71.26%) indicated that their stress/anxiety levels had increased during the pandemic. Fewer than half (43.25%) of the participants indicated that they were able to cope adequately with the stress related to the current situation.

Conclusions: The proportion of respondents showing depression, anxiety, and/or suicidal thoughts is alarming. Respondents reported academic, health, and lifestyle-related concerns caused by the pandemic. Given the unexpected length and severity of the pandemic, these concerns need to be further understood and addressed.

Keywords: mental health; online survey; COVID-19; coronavirus; college student

Introduction

The United States has seen a surge in the number of COVID-19 cases since March 2020, with initial peaks in April 2020 [1]. Recent assessments of mental health among the general populace in China and Iran, countries which had major outbreaks, show increased levels of stress due to the pandemic [2,3]. A key concern during the pandemic relates to the mental health of vulnerable populations, including college students. The 2019 Annual Report of the Center for Collegiate Mental Health [4] reported that anxiety continues to be the most common problem (62.7% of 82,685 respondents) among students who completed the Counseling Center Assessment of Psychological Symptoms. Consistent with the national trend, Texas A&M University has seen an increase in the number of students seeking services for anxiety disorders over the last few years. Given the vulnerability of this population during the pandemic, there is a critical need to assess mental health of college students in order to address concerns in a timely manner [5–8].

Recent assessments of college student mental health in China have shown an increased level of anxiety and depression in the wake of the pandemic [6,9]. These studies used standardized scales for depression and anxiety, such as the depression and anxiety stress scale, Patient Health Questionnaire (PHQ-9) and the Generalized Anxiety Disorder (GAD-7) questionnaire. General panic related to the outbreak and risk of exposure were found to be contributors to increased level of depression. Similarly, Cao et al. [9] assessed anxiety using the GAD-7 scale and found that risk of infection, including to family members, was a major contributor to college students' increased anxiety. Both studies also identified important protective factors such as income stability and the availability of information related to the preventative measures. However, these studies do not include an assessment of strategies used by students themselves towards coping with and managing their stress. Additionally, these studies have focused on the student population in China. Given the differences in cultural, geographic, economic, and other factors, an assessment of college students' mental health in the United States is needed.

The aim of this study was to conduct a survey-based assessment of mental health among college students at Texas A&M University, a large university in the US, during the COVID-19 pandemic. We sought to identify severity levels of depression and anxiety symptoms (primary outcome), as well as stressors related to the pandemic, coping mechanisms used, and barriers experienced by students in handling the pandemic-related stress.

Methods

Recruitment

An online cross-sectional survey was designed and conducted during the initial peak of the COVID-19 pandemic in the late spring 2020 semester at Texas A&M. The research received approval from the university's institutional review board. Guidelines provided by Kelley et al. [10] were used for designing, conducting, and reporting this survey research.

Participants were recruited from the student population. This particular university closed all campuses on March 23, 2020 and held all classes virtually in response to the COVID-19 pandemic. In addition, the State of Texas issued a stay-at-home order on April 2, 2020. The survey was published using the online survey platform, Qualtrics, on May 4, 2020, and data collection remained open until no additional completion was reported for two days (May 19, 2020). During this period,

the survey was announced to the entire population of over 60000 students at the Texas A&M College Station (Texas) Campus, through email.

Survey Design

The survey was designed in a semi-structured format comprising multiple-choice questions and free-text fields for elaboration. The survey consisted of the following sections:

Demographics: This section included questions related to age, gender, college classification, and program of study of the participants.

Patient Health Questionnaire (PHQ-9), a validated and widely-used measure of depression severity in primary and mental healthcare, consisting of 9 items based on depression symptoms. Respondents rate the frequency they suffered from these symptoms within the last two weeks. The categories of severity range are minimal (0–4), mild (5–9), moderate (10–14), moderately severe (15–19) and severe (20–27) [11].

Generalized Anxiety Disorder Screener (GAD-7) is a validated questionnaire used in most mental healthcare settings as a screening tool for major anxiety disorders such as generalized anxiety disorder or panic disorder [12], consisting of 7 items based on GAD symptoms. Respondents rate the frequency of experiencing these symptoms within the last two weeks. The categories of severity range are minimal (0–4), mild (5–9), moderate (10–14), and severe (15–21).

Questions related to COVID-related stress: This section was aimed at identifying various stressors resulting from the pandemic:

- Did your overall stress increase/decrease or remain the same during the ongoing pandemic? (Increase/Decrease/Remain the same)
    - (If participant chose increase/decrease, a follow-up open answer questions appears): Can you describe the main reason for such increase/decrease of stress and anxiety?
- Do you think other students are experiencing stress/anxiety because of the pandemic? (Yes/No)
- In the past month, what level of fear, worry, and/or changes have you experienced related to any of the following academic/health/lifestyle-related concerns? (None/Mild/Moderate/Severe) See results Figures 3-5 for lists of anticipated concerns.
- Did you have any other academic/health/lifestyle-related concerns? (Yes/No)
    - (If participant chose “yes”, a follow-up open answer questions appears): Please specify any other academic related concerns you have.

Coping mechanisms and barriers: This section consisted of multiple-choice questions and open-ended follow-up questions related to ways in which the students coped with stress during the pandemic. Follow-up questions were included to identify specific resources and technological apps that students may have been using as they coped:

- Do you feel you are able to cope adequately with the stress related to the current situation? (Yes/No/Maybe)
- What coping methods/tools/techniques have you used to mitigate your elevated stress/anxiety? (None; University services; Health services outside the university; Support from community, family and friends; Technologies; Other)
    - (If participant chose “university services”, a follow-up question appears): What university services did you use because of the pandemic? (Student health services;

Counseling and psychological services; Other)
- Where are you sourcing your information [about the pandemic] from? (University emails; Your medical provider; Newspaper and periodicals; Medical websites; Posts on social media; Other)
- Have you been using any mobile apps or features on existing apps for managing stress, anxiety, or depression related to the ongoing COVID-19 pandemic? (Yes/No)
    - (If participant chose “yes”, a follow-up open answer questions appears): Please specify what apps/features you have been using.
- In your opinion, what are the barriers to mental health care? (None; Lack of information about resources available; Financial concerns; Limited access to the services; Social stigma; Other)

Data Analysis

For PHQ-9 and GAD-7, mean scores were calculated for different gender and classification groups. The percentages of participants who fall in each severity category were computed. Inspection of the data and residual plots for mean PHQ-9 and GAD-7 scores did not indicate any violation of assumptions of normality, independence, and homogeneity of variance. Therefore, two-way analysis of variance (ANOVA) was conducted to identify significant main effects and interactions between gender and classification groups. For the questions regarding concerns about COVID-19, percentages of participants who chose each severity were computed. For the multiple-choice questions regarding coping mechanisms and barriers, percentages of participants who chose each item were computed. Quantitative analyses were performed using Microsoft Excel and R 4.0.2.

Open-ended questions were coded using thematic analysis [13]. Initial codes were created based on a previous coding scheme used for an interview study [14]. Initial coding consisted of placing all responses to the questions into the initial codes; however, responses that did not fit in the initial codes were placed in new codes generated inductively. Focused coding, following initial coding, consisted of re-categorizing codes and creating additional codes as needed. For the final phase of thematic coding, common themes were identified among the codes and numbers of appearance were counted. The analysis of the open-ended questions was split among four coders: one coder analyzed the questions related to increased or decreased stress (BK); one coder analyzed the questions related to academic concerns (CS); one coder analyzed questions related to health and lifestyle (XW); and one coder analyzed questions related to coping mechanisms and barriers to treatment (AS). Between each phase of coding, the coders and other authors (SH and FS) met and discussed their process to ensure a uniform analysis method. The final coding structure and themes were decided upon in consensus meetings among all authors. Qualitative analyses were performed using Microsoft Excel and MAXQDA [15].

Results

Sample Demographics

A total of 2,031 responses were collected, 1252 (61.64%) of whom were female. Age of the participants ranged from 18 to 75 years (M = 22.88, SD = 5.52). The sample included both undergraduate (1405, 69.18%) and graduate students (620, 30.53%), further classified as freshman (265, 13.05%), sophomore (274, 13.49%), junior (354, 17.43%), senior (512, 25.21%), master’s (294, 14.48%), and doctorate (326, 16.05%). Study program was reported by 1900 participants representing all 15 colleges in the Texas A&M campus. The top represented colleges were Engineering (565, 29.74%), Liberal Arts (261, 13.74%), and Agriculture and Life Sciences (189,

9.95%). Table 1 shows the gender, classification and program (college) proportions of the sample compared to the population.

Table 1. Demographics

	Sample		Population[a]	
	N	%	N	%
Gender				
Female	1252	61.64%	28956	46.60%
Male	757	37.27%	33197	53.40%
Classification				
Undergraduate	1405	69.18%	50454	81.18%
Masters	294	14.48%	6259	10.07%
PhD	326	16.05%	4864	7.83%
Age				
<18	0	0.00%	327	0.53%
18-21	1065	52.44%	31839	51.23%
22-25	532	26.19%	22946	36.92%
26-30	207	10.19%	3947	6.35%
31-39	96	4.73%	2176	3.50%
>39	46	2.26%	918	1.48%
College				
College of Engineering	565	29.74%	18784	30.22%
College of Liberal Arts	261	13.74%	8526	13.72%
College of Agriculture and Life Sciences	189	9.95%	7473	12.02%
College of Education & Human Development	176	9.26%	6630	10.67%
Mays Business School	154	8.11%	6041	9.72%
College of Science	134	7.05%	3828	6.16%
College of Veterinary Medicine & Biomedical Sciences	93	4.89%	3575	5.75%
College of Architecture	78	4.11%	3142	5.06%
School of Public Health	50	2.63%	292	0.47%
College of Geosciences	49	2.58%	1321	2.13%
Bush School of Government & Public Service	36	1.89%	516	0.83%

[a] Population based on fall 2019 student demographics data of Texas A&M, College Station Campus.

Severity of Depression and Anxiety

Depression: Thirty-seven responses were excluded from the PHQ-9 questionnaire analysis because of missing values. Among the 1994 complete responses, 1607 (80.57%) of the participants reported some (any) level of depression, varying as follows: mild (647, 32.45%), moderate (496, 24.87%), moderately severe (316, 15.85%), and severe (148, 7.42%). The two-way ANOVA showed that there were significant main effects of gender ($P < .001$, $\eta^2 = 0.03$) and classification ($P < .001$, $\eta^2 = 0.03$) on PHQ-9 scores. Females had a mean score of 1.76 points higher than males (Mean = 10.61 and 8.84, respectively). Participants in higher classification had lower PHQ-9 scores (Figure 1). Tukey's honest significant difference (HSD) showed a significant difference between doctoral and all undergraduate classifications, between master's and freshman/sophomore/junior, and between senior and freshman ($P < .05$).

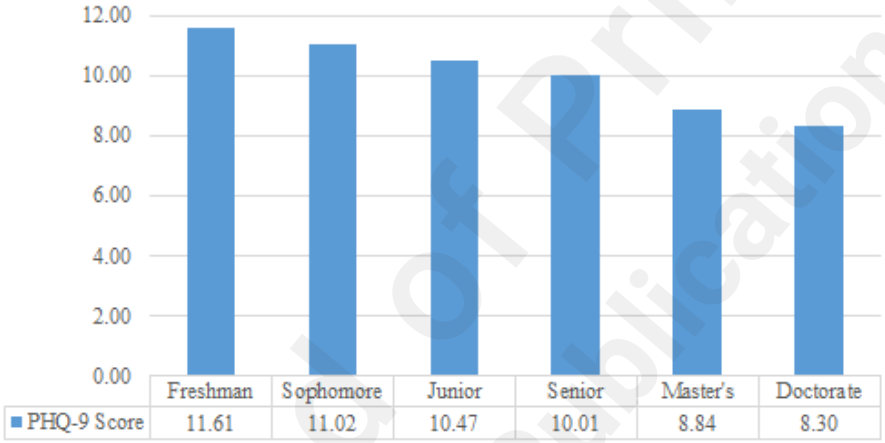

Figure 1. Mean PHQ-9 Score by Classification

Item nine in PHQ-9 ("over the last two weeks, how often have you been bothered by thoughts that you would be better off dead or of hurting yourself in some way") showed that 366 (18.04%) participants had self-harm or suicidal thoughts (250 responded "several days", 74 "more than half the days", and 42 "nearly every day").

Anxiety: Seventeen responses were excluded from the GAD-7 questionnaire analysis because of missing values. Among the 2014 complete responses, 569 (28.25%) showed minimal anxiety, while 71.75% (1445) of the participants showed anxiety, with severity levels varying as mild (670, 33.27%), moderate (477, 23.68%), or severe (298, 14.80%). Two-way ANOVA showed a significant main effect of gender ($P < .001$, $\eta^2 = 0.05$) and classification ($P < .001$, $\eta^2 = 0.02$) on GAD-7 score. Females had a mean score of 2.22 points higher than males (means scores were 9.12 and 6.89, respectively). Participants in higher classification had lower GAD-7 scores (Figure 2). Tukey's HSD test was conducted to test for difference between the classifications, and showed significant difference between doctoral and all undergraduate classification, and between master's and sophomore ($P < .05$).

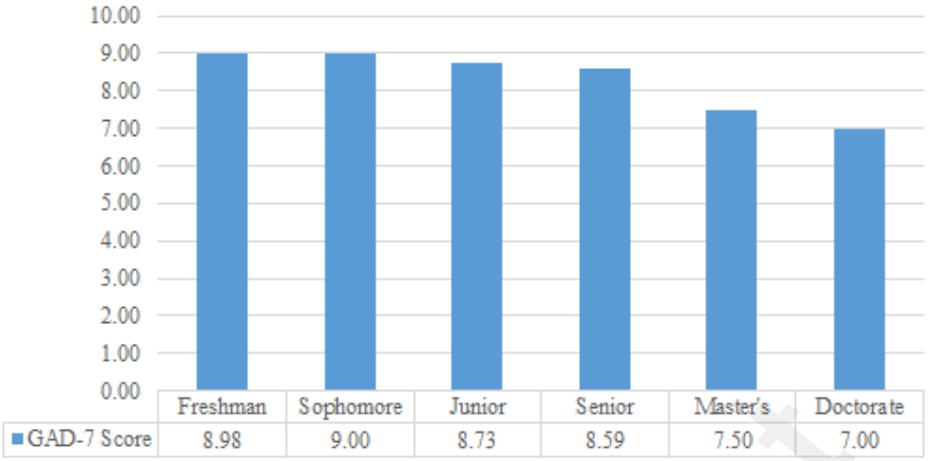

Figure 2. Mean GAD-7 Score by Classification

COVID-related Stress

A majority of participants (1443, 71.26%) indicated that their stress/anxiety levels had increased during the pandemic, while 111 (5.48%) indicated it had decreased and 471 (23.26%) indicated it remained the same as before. A vast majority (1982, 97.83%) of students thought other students were experiencing stress/anxiety because of the pandemic. Participants who indicated change in their stress/anxiety levels were asked to specify reasons for such increase/decrease in a follow-up question.

Reasons for Increase in Stress: Among the participants who indicated increased stress/anxiety (1443) during the pandemic, 1360 participants elaborated on the reasons for such an increase. The biggest contributor was stress related to academics (532/1360; 39.12%), with the majority stemming from increased difficulty (278) due to the precipitous transition and maintenance of online classes, distantly followed by increased concerns over grades (58), and delayed graduation (53). The second most frequent contributor was general uncertainty regarding the pandemic (473/1360; 34.78%). This was followed by health concerns (472/1360; 35.00%), relating to personal mental health (205), health of friends & family (162), and fear of personally contracting COVID-19 (83). The fourth biggest concern related to finances (279/1360; 20.51%), primarily stemming from unemployment or uncertainty of future employment (183). Living/Work Environment (276/1360; 20.29%) was the next biggest contributor, consisting of concerns related to working from home (79), cabin fever (59), returning home (49), and confinement with others (47). Impacted social life (252/1360; 18.53%) was the last major category, primarily consisting of isolation (186).

Reasons for Decrease in Stress: A few respondents (109) elaborated on the reasons that they were experiencing decreased stress and anxiety during the pandemic. The majority of these respondents mentioned that this was due to time saved (47/109; 43.1%) as a result of not having to commute to school, reduced schoolwork, and not having to engage in extracurricular and organizational activities, which are otherwise a part of campus-life. A key benefit of the transition to distance learning was the flexibility (20) of schedule, particularly when lecture recordings could be viewed on their own time. Several students (13) also mentioned using additional time available to pursue hobbies and other interests, as well as to amplify proactive health behaviors such as meditation and exercise. Interestingly, some students (8) reported that they were experiencing reduced social anxiety from not having to interact with other students.

Apart from the general comments on the stressors, participants also rated severity of the effect by specific academic-related, health-related and lifestyle-related concerns.

Academic-related Concerns: Among the academic-related concerns (Figure 3), 1851 (90.74%) of the participants had difficulty in concentrating, with 716 (35.10%) having a moderate level and 706 (34.61%) having severe difficulty. Similarly, over 80% participants had concerns regarding their academic progress and future plans (1830, 89.57%), and academic performance (1752, 85.71%). A majority of the participants also had difficulty adapting to distance learning (1554, 76.03%), or had increased class workload (1358, 66.57%).

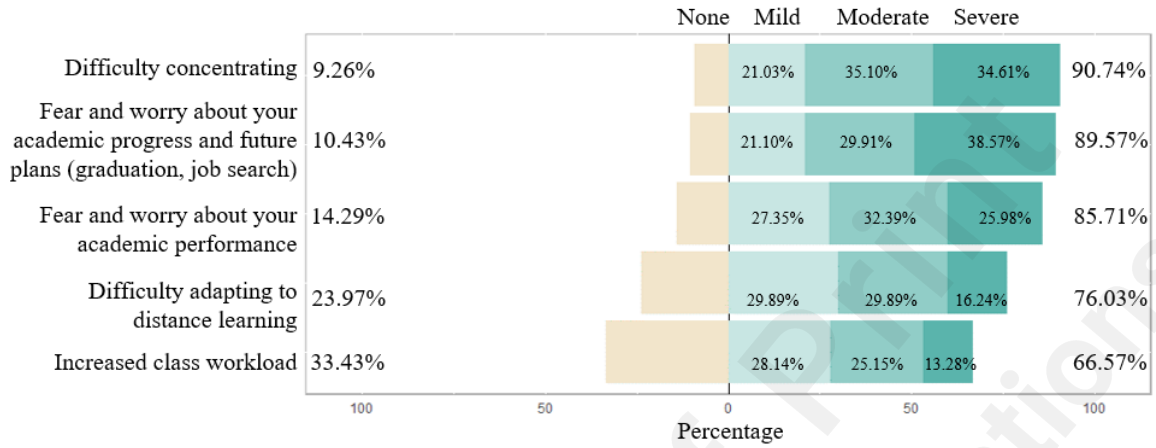

Figure 3. Academic-related Concerns

A small portion of participants (389) provided additional free-response reasons behind the increased level of stress related to academics. Nearly one fifth of those who indicated such reasons (73/389; 18.8%) indicated financial concerns related to their academic situations such as reduced current and prospective job opportunities (42), increased burden to pay tuition and fees (16), and impacts on scholarship and funding (15). Some of the participants (27/389; 6.9%) presented their worry about future semesters, such as continuing online classes in following semesters (12), choosing a major in the middle of the pandemic situation (10), and resuming in-person classes with persistent risks of virus infection (5).

Health-related Concerns: As Figure 4 shows, the top health-related concern was fear and worry about personal health and the health of loved ones (1825, 89.24%), followed by changes in sleeping habits (1735, 84.92%), eating patterns (1641, 80.44%), and depressive thoughts (1362, 66.67%).

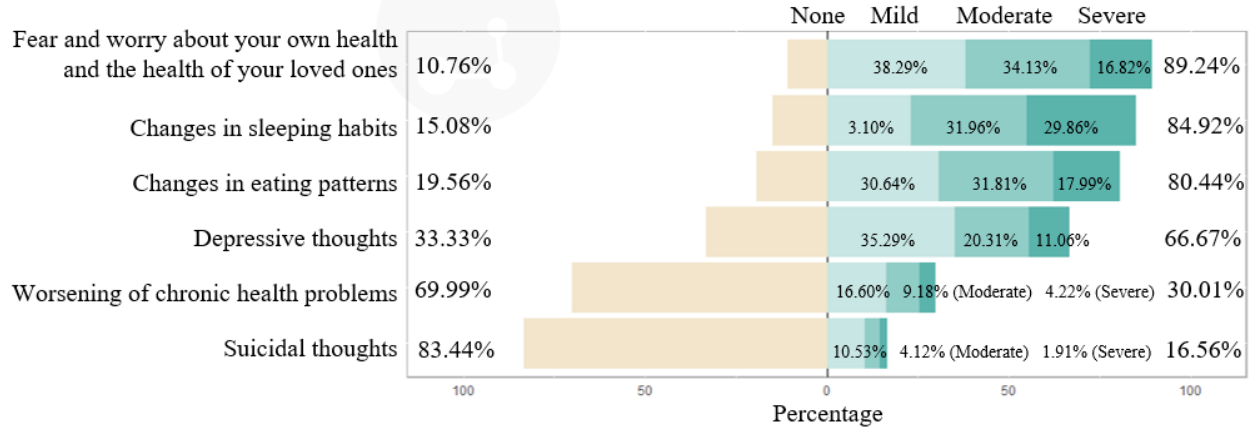

Figure 4. Health-related Concerns

Some participants (180) added health-related concerns in the free responses. The biggest concern was physical illness (52/180; 29.9%), including having physical illness (31) and worsened during the pandemic (6). Some were at higher risk of getting infected COVID-19 due to asthma (9), autoimmune disease (4), being immunocompromised (3) or other disease (3). Four participants reported that they have infected COVID-19. Fitness was another concern (49/180; 28.2%), including decreased exercise (45), weight gain (12) and muscle/back pain due to sedentary (5). Some participants reported having diagnosed mental illness (31), and worsened during the pandemic (11). Barriers to health care were mentioned by 29 participants, including barriers or worries to visit doctors for non-pandemic issues (24), barriers to get medication (3), and barriers to get tested for COVID-19 (2).

Lifestyle-related Concerns: More than half of the participants reported having the top seven lifestyle concerns (Figure 5). It was not surprising that "changes to social relations or social isolation" (1775, 86.80%) and "social/physical distancing" (1741, 85.43%) were the top two lifestyle concerns.

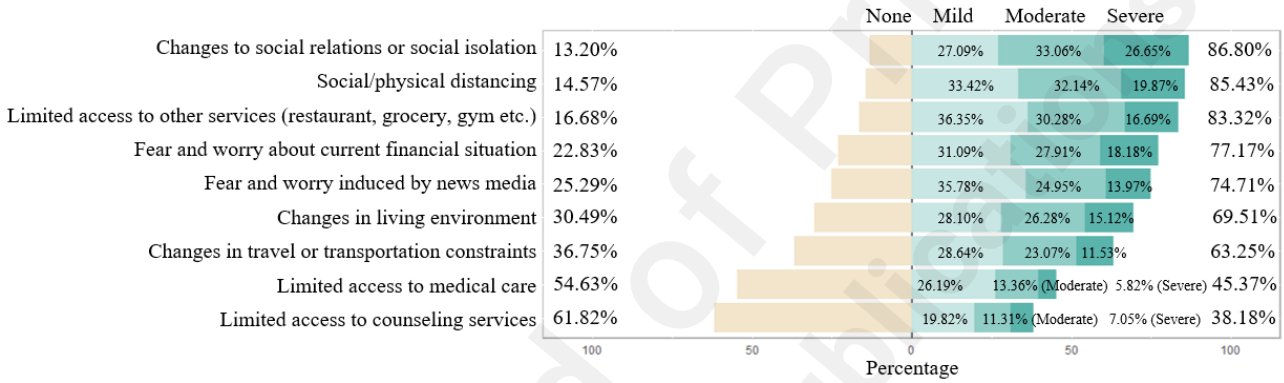

Figure 5. Lifestyle-related Concerns

Some participants (174) mentioned additional concerns related to lifestyle changes in the free responses. The major concern was relationship (71/174; 40.8%), including social activities affected by isolation (45), as well as relationship issue with family members (18) and roommates (8). Some participants had difficulty working (17), due to unsatisfying work environments (9) such as internet issues (2), or had difficulty following a schedule (8). Other concerns included uncertainty of the future (12), worry because others do not perform social-distancing (11), and worry of bringing the virus to the family as essential workers (2).

Coping Mechanisms and Barriers

Coping mechanisms: Nearly half (882, 43.25%) of the participants indicated via multiple choice responses that they were able to cope adequately with the stress related to the current situation, while 323 (15.84%) said they were not able to cope. The rest were unsure (834, 40.90%). When asked what coping mechanisms were used to mitigate stress/anxiety, more than half (1362, 67.06%) of the participants chose "support from community, family and friends", followed by "technologies (websites, mobile apps, sensors that help monitor health data)" (659, 32.45%). Few participants reported using university health services such as counseling service (210, 10.34%) or health services outside the university (89, 4.38%). Some of the participants (387, 19.05%) reported using no coping mechanism.

Some respondents (386) indicated that they used other coping mechanisms to reduce stress during the COVID-19, and provided elaboration in the free response. Many of these respondents (152/386; 39.0%) mentioned engaging in health lifestyle activities such as exercise (130), diet maintenance

(11) and self-care activities (11). A similar number of respondents (143/386; 37.1%) engaged in relaxing activities including meditation (48), reading (21), playing with pets (13), listening to music (12), breathing exercises (4), sleeping (3), shooting for sport (2), gardening (1), and other hobbies in general (29) alongside general relaxing activities (10). Beyond relaxing activities, some respondents engaged in creative activities (31/386; 8.0%) which included creating pieces of art (10), writing (18) and playing musical instruments (3). Additionally, respondents mentioned engaging in spiritual and religious activities (69) such as reading sacred texts and praying. A small percentage of the respondents also engaged in negative coping methods (41/386; 10.6%) including distracting themselves (20), excessive intake of alcohol (5), isolation (2), auto-manipulation (2), and crying (1). Lastly, some respondents maintained focus on their work and professional activities (16/386; 4.2%) by focusing on school (4), continuing work (3), or managing their time for productive use.

Smartphone Apps for Coping with COVID-19: A small number of participants (290, 14.28%) indicated that they have been using mobile apps for managing added stress related to the pandemic, 278 of whom provided specific names of the apps or features. Most of these respondents (201/278; 72.3%) used an application focused on mindfulness. Most of these mindfulness apps focused on meditation (144), such as Headspace, while relaxation apps (42) and apps centered on focused breathing (15) were also used. Social media (46/278; 16.5%) was used by some of the respondents with most using the typical social media sites (e.g., Twitter, Facebook, Instagram and TikTok) and apps (32) for entertainment purposes while others used YouTube (14). Some of the respondents used lifestyle apps (37/278; 13.3%) including exercise apps (23), time management (9), sleep tracking (5) and food tracking (2). A small number of respondents (6/278; 2.2%) played video game apps to cope with stress during COVID-19.

Sources of Information for COVID-19: The main sources of information related to the pandemic were university emails (1257, 61.89%), newspapers and periodicals in paper or online (1221, 60.12%) and posts on social media (1026, 50.52%). Some participants also received information from medical websites (591, 29.10%) or their medical providers (315, 15.51%).

A small number of respondents (235) elaborated on the other information sources in open-ended responses. About a quarter (60/235; 25.5%) of these respondents received their information from more traditional media including television (34), online articles (19), and the radio (7). A similar number of participants (55/235; 23.4%) received their information from family and friends. Other respondents listened to figures of authority (50/235; 21.3%) for their information regarding COVID-19, split between government officials and organizations, including presidential briefings and local leaders (32) on one hand, and prominent scientists and researchers (28) on the other. Finally, some respondents preferred to rely on themselves to stay informed (21/235; 8.9%) by conducting searches and reading relevant sources (4) or by ignoring the news due to disbelief in or indifference to the current situation (17).

Barriers for mental health care: The major barriers to mental health care were “financial concerns (fees and insurance)” (1434, 70.61%), “social stigma” (1194, 58.79%), “lack of information about resources available” (1099, 54.11%), and “limited access to the services (e.g. could not get scheduled)” (978, 48.15%%).

A few of the respondents (167) indicated that they experienced other barriers, and elaborated in free response. Some of the respondents perceived that they themselves (69/167; 41.3%) can be the biggest barrier to reaching out for help: some doubted the efficacy of care (8); some mentioned that they or others may not see a problem, even if it exists (22); others mentioned not wanting help (7). Respondents cited an overall feeling of discomfort (25/167; 15.0%) with the topic of mental health

and difficulty bringing up the topic with others. Some of the respondents mentioned poor quality (22/167; 13.2%) in their treatment as a barrier to seeking treatment again.

Discussion

Principal Findings

Among the 2031 participants, 48.14% showed moderate to severe level of depression, 38.48% showed mild to severe level of anxiety, and 18.04% of participants had suicidal thoughts in the past two weeks. Gender and classification had significant effects on depression and anxiety severity ($P < 0.001$). Female respondents reported higher scores, while respondents in higher classification reported lower scores on PHQ-9 and GAD-7. A majority of participants (71.26%) indicated that their stress/anxiety levels had increased during the pandemic. Less than half (43.25%) of the participants indicated that they were able to cope adequately with the stress related to the current situation.

The survey had a healthy representation across genders and classifications of undergraduate and graduate students. A vast majority (80.57%) of respondents had scores on the PHQ-9 which indicated some level of depression (defined as a total score of ≥ 5 in the PHQ-9), with about 48% in the moderate to severe range. This proportion of respondents showing depression is much larger than those found in recent assessments in China. For instance, in their survey of 509 college students, Liu et al. [16] found that about 19% of their respondents showed some level of depression. Our findings also show a higher proportion of respondents with depressive symptoms among students than findings in several recent studies in non-pandemic situations [17,18]. Furthermore, nearly 1 in 5 respondents reported having suicidal thoughts. This finding is in line with the increased suicide rates observed during previous pandemics [19]. In comparison, previous research has reported about 3% to 7% of the college student population had suicidal thoughts outside of a pandemic situation [20]. This is an alarming finding warranting immediate attention. Additionally, a majority of our respondents (71.75%) showed some level of anxiety (defined as a total score of ≥ 5 in the GAD-7), with over 38% in the moderate to severe range. Again, this is a much higher proportion than in similar survey-based assessments by Liu et al. [16] and Cao et al. [9], who found some level of anxiety in 8.8% (out of 509) and 24.9% (out of 7143) of respondents, respectively. Clearly, there is a pressing need to actively provide support to vulnerable students in managing their mental health.

Not surprisingly, given the above findings, a majority of respondents reported that their stress and anxiety had increased during the pandemic. In general, this is consistent with the heightened levels of psychological distress reported among various populations during the current pandemic and previous epidemics such as SARS [6,7,9,21]. This finding could be underpinned by the high levels of academic, health and lifestyle concerns and changes. A vast majority indicated difficulty concentrating, fear and worry about academic progress and performance, and adjustment to distance learning as dominant academic concerns. To our knowledge, this is the first study that reports these specific effects of the COVID-19 pandemic as related to academic concerns. Given that several universities, including Texas A&M, are continuing partially with distance learning for the remainder of the year, these concerns need to be probed further in order to be adequately addressed.

Among health-related concerns, a majority of students expressed concerns about their own health or the health of loved ones, echoing recent findings [6]. A large proportion (over 80%) of respondents reported changes in eating and sleeping habits. Again, this is not surprising, but certainly concerning, given previous research which has shown that such changes are correlated with depression among college students [22]. Among lifestyle-related concerns, physical distancing and changes in social relations were widely reported, similar to those found earlier among students as well as the general

population [6,23]. Additionally, three quarters of respondents indicated fear and worry induced by the news media. This type of distress may be exacerbated by the large amount of misinformation, including false and fabricated information, distributed through news and social media [24].

More than half of the respondents who described coping mechanisms mentioned support from family and friends as a key factor, similar to previous findings [6,9]. Several respondents also mentioned the use of technology, such as mobile apps and other digital platforms, as a means of positive coping practices, such as meditation, echoing recent findings on the positive effect of a mindfulness app on college students' mental health [25]. This indicates some potential for mobile-based technologies to support mental health. Such platforms may have the added benefit of helping overcome the barrier of social stigma related to seeking help from counseling services. Identifying such positive coping behaviors is important in order to enable such behaviors through symptoms-level support.

Limitations and Future Work

Several limitations may impact the generalizability of the findings reported in this paper. Most importantly, some of our findings may be biased because of self-selection by the respondents. The higher percentage of respondents with depression/anxiety may be related to this bias. Particularly, the slightly higher level of depression/anxiety among females may be attributed to the slightly higher percentage of female respondents. Additionally, we did not ask if respondents had any existing mental health issues or were receiving treatment before the pandemic. In fact, 31 respondents mentioned on their own that they had been diagnosed with some form of mental illness earlier. Therefore, we are unable to clarify whether our findings have been biased by a population of respondents with pre-existing or heightened levels of distress, who may have been more inclined to participate in the survey than those who were less distressed.

The survey is cross-sectional and lacks comparison to a typical semester without the effect of the pandemic, or a different time point of the year. Huckins et al. [26] tracked depression and anxiety severity of 217 undergraduate students using PHQ-4 and GAD-2 during spring 2020. It was found that depression and anxiety level spiked when the campus switched to remote learning, but decreased in the following two weeks. It is valuable to keep monitoring the change to understand the long-term effect of the pandemic.

An interesting finding is the differences in depression/anxiety levels among the different classifications. Undergraduate students might have received more impact during the pandemic compared to graduate students, probably from adapting to distance learning. Yet the precise factors need further investigation in future study.

The proportion of respondents showing depression, anxiety, and/or suicidal thoughts is alarming. Respondents reported academic, health, and lifestyle-related concerns caused by the pandemic. Given the unexpected length and severity of the pandemic, these concerns need to be further understood and addressed. Further study on the most at-risk populations and evidence-based interventions should proceed as soon as possible to prevent a secondary epidemic, embedded within the COVID pandemic, of serious, nationwide mental affliction and potential physical self-harm among vulnerable college students.

At an institutional level, online remote activities and services can be implemented to provide support to student that help address concerns related to the pandemic. For example, Schlesselman, Cain and DiVall [27] provided a list of activities that can potentially support students in fitness, socialization, and academic success (e.g. virtual group exercise, virtual movie night and virtual office hours).

However, there is no one-size-fits-all solution. The appropriate way to implement such support and the long-term effect of the interventions need further study.

Conflicts of Interest

None declared.

Abbreviations

ANOVA: Analysis of Variance
COVID-19: Coronavirus Disease 2019
GAD-7: General Anxiety Disorder 7-item
PHQ-9: Patient Health Questionnaire 9-item
Tukey's HSD: Tukey's honest significant difference

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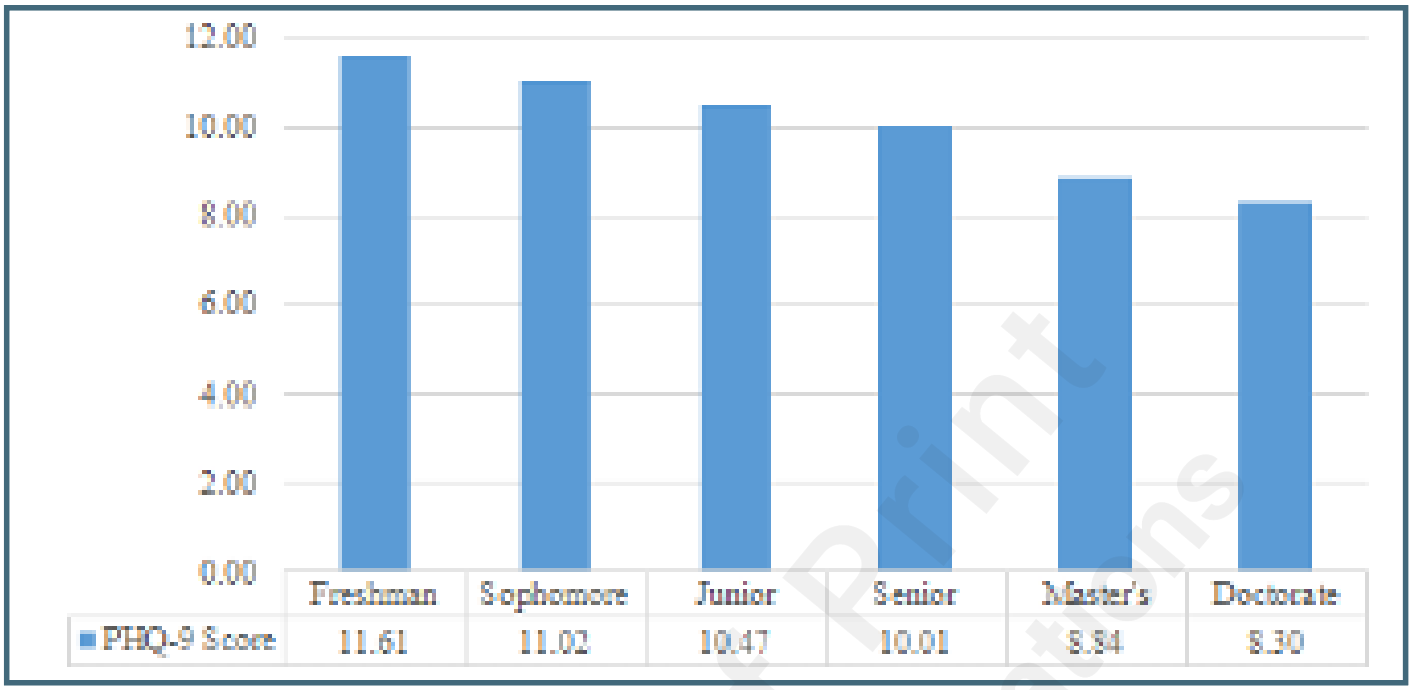
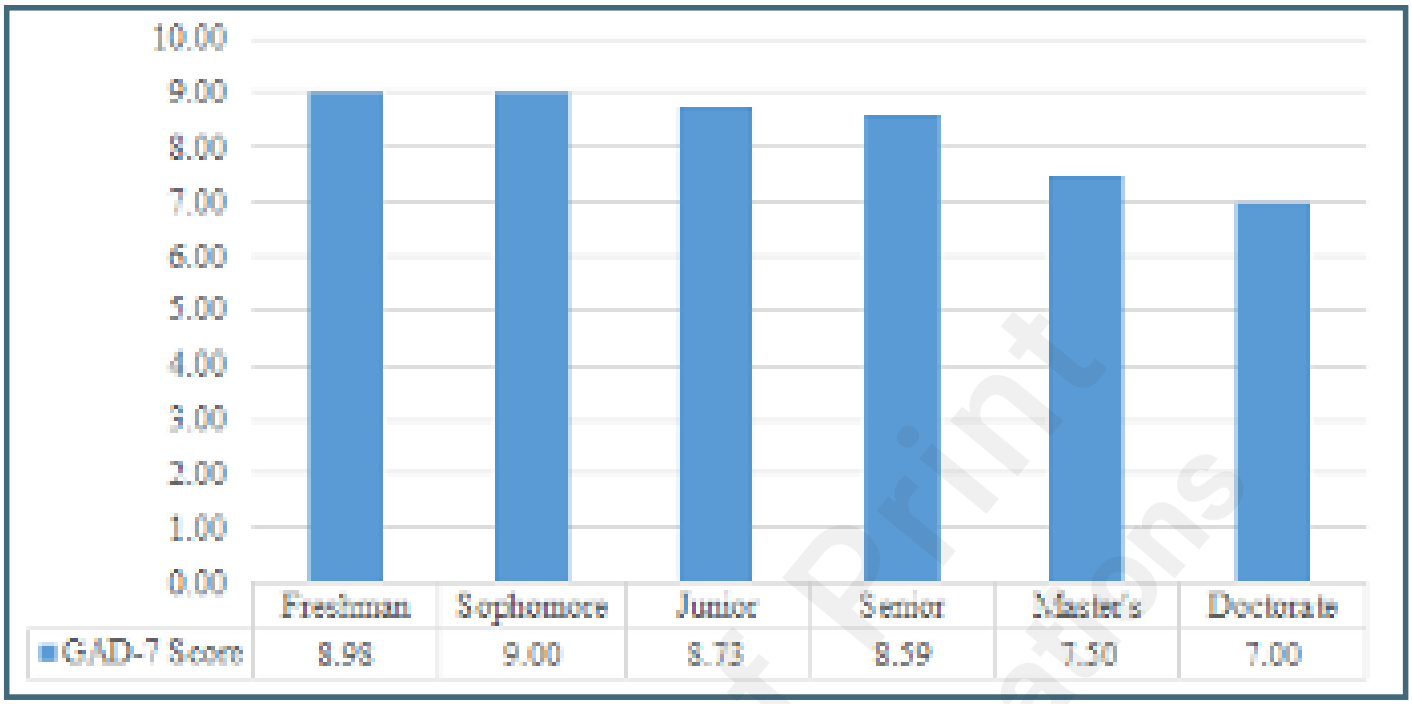
Supplementary Files

Figures

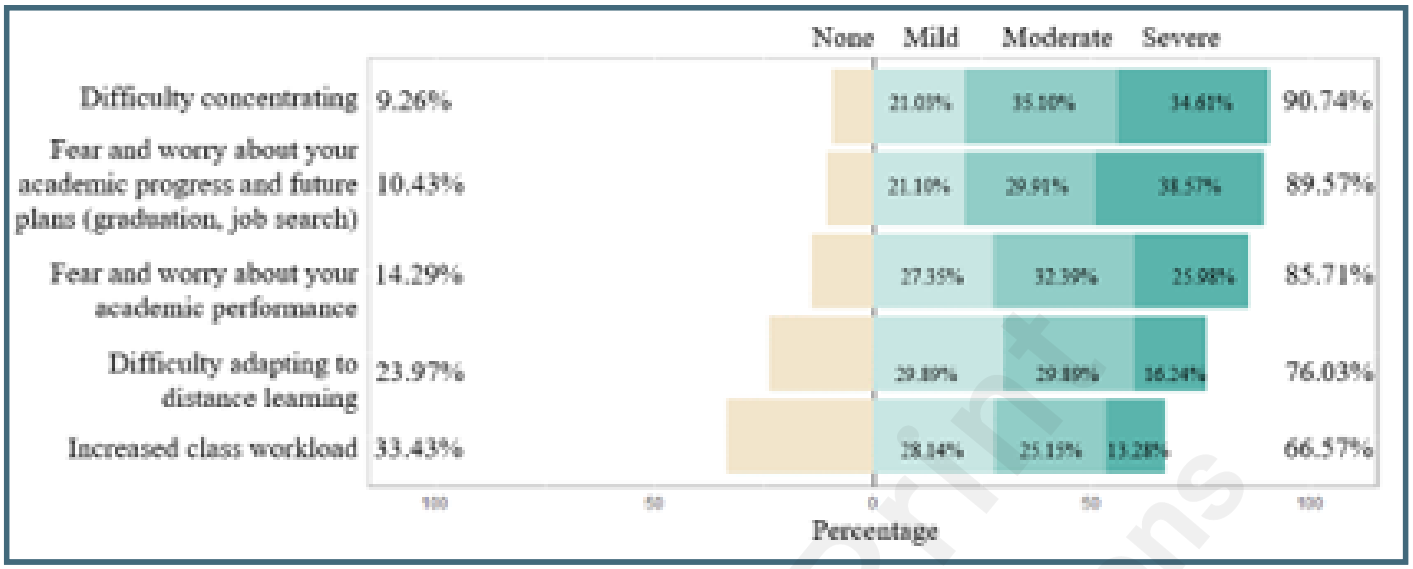
Mean PHQ-9 Score by Classification.



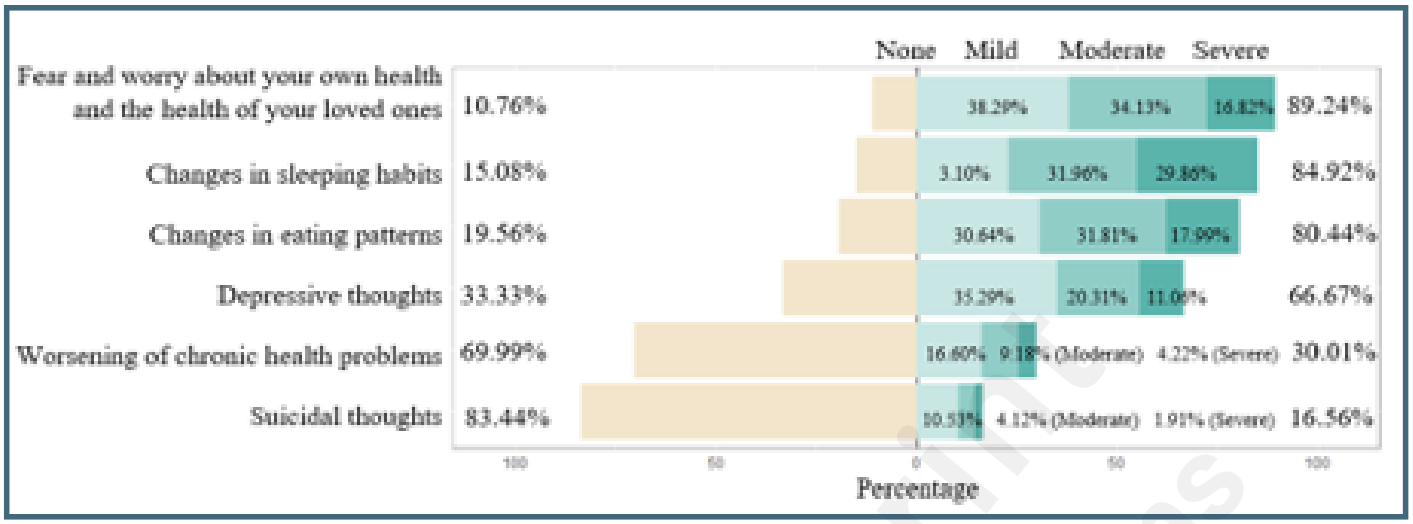
Mean GAD-7 Score by Classification.



Academic-related Concerns.



Health-related Concerns.



Lifestyle-related Concerns.