Psychosocial Stressors Affecting the Mental Health of Young Adults During the COVID-19 Pandemic

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PSYCHOSOCIAL STRESSORS AFFECTING THE MENTAL HEALTH OF YOUNG

ADULTS DURING THE COVID-19 PANDEMIC

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A Thesis Submitted to the Faculty of

Harvard Medical School

in Partial Fulfillment of the Requirements for the Degree of

Master of Medical Sciences in Clinical Investigation

(MMSCI)

Harvard University

Boston, Massachusetts

March 2023

Area of Concentration: Mental Health/Psychiatry

Project Advisors: Dr. Cindy H. Liu, Dr. Nomi Levy-Carrick, Dr. Gearoid M. McMahon

I have reviewed this thesis. It represents work done by the author under my guidance.

Primary Mentor: Dr. Cindy H. Liu

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Acknowledgements

First and foremost, all thanks is to Allah the Almighty, the Most Gracious, and the Most Merciful for His uncountable blessings. May Allah's blessings and peace be upon His final Prophet Muhammad (Sallallahu Alaihi Wasallam), his family, and his companions.

I want to thank my parents, my brothers, and my wife for their exceptional and unwavering support and encouragement.

I want to thank my mentor, Dr. Cindy H. Liu, without whom none of the work in this thesis (and much of the work beyond) would have been possible. She patiently guided and taught me, and I will forever be grateful to her dedication. Words cannot describe my gratitude to Dr. Liu. I pray to have the strength to pay it forward by being as good of a mentor to my mentees as Dr. Liu was to me.

I am grateful to Dr. Youssef Farag, whose wisdom and timely guidance were crucial during challenging moments. His support and guidance left lifelong impact on my personal and professional life.

I want to thank Dr. Finnian McCausland and Dr. Ajay Singh for their huge support throughout my academic journey. Their willingness to provide the resources I needed has been an invaluable source of motivation in my pursuit of opportunities to advance my career.

I want to thank Dr. Cindy Liu's collaborators, Dr. Justin Chen, and Dr. Courtney Stevens, for their invaluable support and guidance on my research. I also want to thank all my labmates, who made my lab feel like my second home.

I want to thank Dr. Natalie Feldman and Dr. Abdelkader Alam whose support were critical to my residency applications. I also want to thank Dr. Pamela Mahon for taking the time to find the perfect research mentor for me and for connecting me with Dr. Cindy Liu.

I want to thank Dr. Nadeem Kasmani, who was my teacher, mentor, and friend and whom I could always turn to for help. Dr. Kasmani's unwavering support was critical to both my personal and professional wellbeing. I also want to thank Dr. Joia Mukherjee, who was incredibly welcoming and helpful to me during my journey at the Global Health Department.

I want to thank the entire Harvard Longwood Muslim community for being my second home, for their wonderful friendship and support, and for being my safe haven throughout my time in Boston. I want to thank my friends and classmates who made my journey during the program the best I could ask for. I want to thank Dr. Ashraf Nabhan and Dr. Yasser AbdelRazek whose support was critical in my journey to and during my master's program. I want to thank the Dubai-Harvard Foundation for Medical Research for helping support my education and research.

Background

College students worldwide have faced unique stressors during the COVID-19 pandemic (1,2). In the US, high rates of college students experienced unemployment (3,4), social and professional isolation (5–7), and an unprecedented number had to relocate back to their parents' home due to college campus closures (5,6). These activities - working, socializing, and transitioning to independence - are all essential to the mental wellbeing of college students. Consequently, disruptions have led to increased rates of depression and anxiety among this cohort (8,9).

The central aspect of college students' lives is their education. Conventional in-person education was disrupted at most universities across the US, and the transition to online education posed major challenges to college students (10). For example, students had to secure a quiet place, suitable equipment, and a reliable internet connection on a regular basis in order to participate in class (10). Many students lacked access to such resources and were left behind. Even students who could resume their education remotely missed out on crucial aspects of college life such as networking, extracurriculars, and forming lasting relationships (10,11).

Existing literature on the mental health crisis among college students before and during the COVID-19 pandemic (12–14) suggests that there is a gap in understanding how these different experiences impacted college students. This gap is particularly salient for young adults, who were perceived to be "healthier" and at lower risk for COVID-19 complications but entered the pandemic with a pre-existing mental health crisis (12). Our study seeks to address this gap by analyzing a cross-sectional national dataset of US college students, aiming to test the following hypotheses:

Hypothesis 1: College students who reported testing positive for COVID-19, losing a loved one to COVID-19, or experiencing increased financial hardship due to COVID-19 reported higher distress levels than students who did not report these experiences in Spring 2021.

Hypothesis 2: College students who attended classes in a mixed format (online classes with an in-person component) reported lower distress levels than students who attended classes fully online in Spring 2021.

Our primary outcome of interest is psychological distress, as measured by the Kessler Screening Scale for Psychological Distress (K6; 15). High scores on K6 are correlated with lower functioning and higher rates of substance use, other risky behaviors, and mental healthcare utilization (16). By investigating the relationship between pandemic-related stressors and psychological distress, this study will provide valuable insights into the experiences of college students and inform the development of targeted mental health interventions and policies.

Paper 1: Real-world Impacts of COVID-19 on College Student Distress

ElTohamy, A., Hyun, S., Macaranas, A. R., Chen, J. A., Stevens, C., & Liu, C. H. (2022).

Testing positive, losing a loved one, and financial hardship: Real-world impacts of

COVID-19 on US college student distress. *Journal of Affective Disorders*, *314*, 357–364.

https://doi.org/10.1016/j.jad.2022.07.022

Testing positive, losing a loved one, and financial hardship: Real-world impacts of COVID-19 on US college student distress

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A B S T R A C T

Background: The COVID-19 pandemic has taken a particularly heavy toll on U.S. college students. In addition to facing academic-related stress and social pressures, these individuals are now increasingly susceptible to experiences such as contracting the virus, losing loved ones to COVID-19, or facing financial hardship due to the pandemic. The effects of such personal, pandemic-related experiences on young adult mental health — and the inherent racial disparities within these outcomes — remain largely understudied.
Methods: We analyzed 65,568 undergraduate students from the Spring 2021 American College Health Association-National College Health Assessment (ACHA-NCHA).
Results: The rates of the aforementioned COVID-19-related stressors were unevenly distributed across racial groups. A logistic regression analysis to identify predictors of moderate and serious psychological distress revealed that participants who had experienced the death of a loved one had 1.14 times greater odds of developing psychological distress ($p < 0.0001$). Those who experienced financial hardship had an odds ratio of 1.78 ($p < 0.0001$). Surprisingly, testing positive for COVID-19 was associated with an odds ratio of 0.82 of psychological distress ($p < 0.0001$).
Limitations: Self-reported measures are susceptible to recall bias and misinterpretation. Exposure and outcome variables were measured simultaneously in this cross-sectional study which limits inference on causality.
Conclusions: Financial burdens and bereavement are especially impactful stressors among college students during the pandemic, whereas contracting COVID-19 seemingly exhibits less impact on distress levels. When addressing student wellbeing, institutions should consider prioritizing the implementation of resources to support individuals affected by pandemic-related financial and familial losses.

1. Introduction

The COVID-19 pandemic has uniquely disrupted the life of college students, presenting a significant challenge given the already high rates of mental health concerns among this population (Huckins et al., 2020; Mack et al., 2021; Son et al., 2020; Zapata-Ospina et al., 2021). Unlike other individuals, college students primarily live and work on university and institutional campuses. The displacement of many college students from their campuses at the beginning of the pandemic led to a sudden loss of campus resources, social networks, and other in-person support systems. Another major challenge was the adjustment to remote learning within a new environment (e.g., back home with parents and/ or family) (Conrad et al., 2021; Huckins et al., 2020). Rates of anxiety and depression among U.S. college students, already climbing for years, reached unprecedented levels in 2020 with 6 out of every 10 students reporting symptoms of anxiety or depression (Lee et al., 2021; Liu et al., 2020; Wang et al., 2020).

In addition to these unique circumstances, college students have

experienced pandemic-related hardships that may also affect their mental health and well-being, including losing family members to COVID-19, experiencing financial stress, or contracting COVID-19 themselves. While young people have been less likely to experience severe COVID-19 infections, people aged 18 to 29 years account for 16.4 % of all confirmed COVID-19 cases in the U.S. (Centers for Disease Control and Prevention, 2020). Although relatively less severe, contracting the COVID-19 virus and managing the illness and its contagion is yet another stressful event for college students, especially as they maintain other responsibilities, and may also take a toll on mental health. A meta-analysis of 31 studies on COVID-19-positive participants found a prevalence of depression, anxiety, and sleep disturbance of 45 %, 47 %, and 34 %, respectively (Deng et al., 2021). Racial minorities are experiencing a disproportionate burden of COVID-19 infections and hospitalizations with COVID-19 mortality rates up to 105 % higher than in White individuals (Mude et al., 2021).

Approximately 1 in 5 people in the U.S. have experienced the loss of a close friend or relative to COVID-19 (Neergaard et al., 2021). While such data on college students remain limited, one pre-pandemic study of 118 students from a single U.S. university suggested that 30 % of college students will have experienced the loss of a family member within the preceding 12 months (Balk et al., 2010). In that study, 1.7 % of the students who lost a family member within 12 months experienced prolonged grief disorder, which the authors define as distress for at least 6 months.

Young adults have also experienced significant financial hardship as a result of the pandemic. Unemployment constitutes one of the most commonly reported losses during the pandemic (Aucejo et al., 2020), with unemployment rates among 16-to-24 year olds reaching 24.4 % in Spring of 2020, up 16 % from the prior year (Gould and Kassa, 2020). Similar rates were seen in a cross-sectional study of 654 students from a private U.S. university, in which 28.3 % of the students reported losing their job or losing work hours (Birmingham et al., 2021). In that study, 40.8 % of the students reported that their financial situation worsened, 28 % reported being very concerned about their financial stability, and over half were anxious that they would be unable to make ends meet in the next few months. It is important to note that disparities exist in the financial repercussions of the pandemic, with Latinx and Black individuals reporting higher rates of economic challenges due to the pandemic compared to White individuals (Getachew et al., 2020).

Despite these challenges among young adults, very little research to date has examined rates of U.S. college students who tested positive for COVID-19, lost a loved one to COVID-19, and/or experienced financial hardship, or the association between these experiences and psychological distress. Psychological distress refers to a diverse set of cognitive, behavioral, emotional, and psychophysiological symptoms that are usually elevated in patients with depression, anxiety, burnout, and related mental health disorders (Dyrbye et al., 2006; Kessler et al., 2002), and which have implications for health-related quality of life (Mitchell and Beals, 2011). Around two-thirds of college students in the U.S. have moderate or severe psychological distress (American College Health Association, 2022). Psychological distress is a dimensional measure that was chosen over a more symptom-based measure (like anxiety or depression) given the multidimensional nature of the psychological response of college students during the COVID-19 pandemic and its ease of implementation for screening a broad college student population (Kessler et al., 2002; Li et al., 2021a; Son et al., 2020). Some psychological impacts are quantifiable, including depression, anxiety, stress, and PTSD (Li et al., 2021a). Other impacts are harder to quantify, like increased difficulty concentrating or increased social isolation (Son et al., 2020). Some impacts are multifactorial. For example, distress during COVID-19 was exacerbated by stressors that were not previously associated with health anxiety, like worrying about the socioeconomic impacts of getting sick (Taylor et al., 2020).

To further assess the personal experiences and the psychological distress of U.S. college students during the COVID-19 pandemic, this study utilized a large nationwide sample of U.S. college students from Spring 2021 to determine rates of the following experiences: having tested positive for COVID-19, lost a loved one to COVID-19, and/or experiencing financial hardship, and to assess whether these experiences were associated with elevated levels of psychological distress. In selecting these stressors, we wanted to investigate the effects of circumstances that were highly prevalent to our population of college students (testing positive for COVID-19 and facing financial hardship) in addition to a personal life experience directly related to consequences of COVID-19 exposure (losing a loved one to COVID-19). We also stratified the rates by race/ethnicity. In doing so, we leveraged the large sample by disaggregating racial subgroups to better understand the experiences of Middle Eastern and Native Hawaiian/Pacific Islanders subgroups that are often aggregated with other groups or categorized as "other."

2. Methods

2.1. Data source and sample

The American College Health Association – National College Health Assessment III (ACHA-NCHA) is a survey distributed twice-annually that assesses various health and behavioral aspects of US college students, including questions and standardized scales that tap into the study participants' physical health, mental health, habits, and perceptions (American College Health Association, 2021). This analysis is based on the Spring 2021 cross-sectional survey of the ACHA-NCHA, which was entirely web-based and had overall response rates of 12.8 %. The Spring 2021 survey includes 70,087 undergraduate students from 137 participating institutions across the US. Institutions were required to either survey all of their students or to use a random-sampling technique to survey their students. Data collection took place between January and early June, with most of the data collected during February and March 2021. For the purposes of our study, we included only the 65,568 undergraduate students who have completed the questionnaire items that went into our analysis. This analysis was exempt from human subjects review according to the Institutional Review Board of Mass General Brigham.

3. Measures

3.1. Predictors

3.1.1. Tested positive

Students were asked whether they have ever had COVID-19. The options included "Yes (confirmed by a test)," "Maybe (e.g., I have had symptoms consistent with COVID-19, but it was not confirmed by a test)," "Probably not (no symptoms or other reason to think I have had it)," and "No (confirmed by a negative test)." Those who selected "Yes (confirmed by a test)" were referred to as the "Tested positive" group and the remainder were categorized as "Not tested positive."

3.1.2. Death of a loved one due to COVID-19

Students were asked whether someone close to them (a loved one, close family member, or friend) had died due to COVID-19. The options were dichotomous in the form of "yes" or "no."

3.1.3. Experienced financial hardship

Using a 5-point Likert scale, students indicated the effect of the COVID-19 pandemic on their financial situation. The options ranged from "A lot more stressful" to "A lot less stressful," with the middle option indicating that there was "No significant change" to their financial situation. Students who selected "A lot more stressful" and those who selected "Somewhat more stressful" were categorized as "Yes, experienced financial hardship" group, whereas those who selected "No change in my level of stress," "Somewhat decreased my level of stress," or "Significantly decreased my level of stress" were categorized as "No,

did not experience hardship."

3.2. Outcomes

3.2.1. Psychological distress

The Kessler Screening Scale for Psychological Distress (Kessler et al., 2002) was used to assess the participants' psychological distress. Participants were asked on a scale of 0 (none of the time) to 4 (all of the time) how often they felt each of six different indicators: nervous, hopeless, restless or fidgety, so sad that nothing can cheer them up, that everything was an effort, and/or worthless. Cronbach's α for these items in our sample was 0.89, indicating good reliability. As used previously (Yiengprugsawan et al., 2014), scores of 0 to 8 indicate no or low psychological distress, 9 to 12 indicate moderate psychological distress, and 13 to 24 indicate serious psychological distress. Our outcome was dichotomized with 1 indicating moderate-to-serious psychological distress and 0 indicating no or low psychological distress.

3.3. Covariates

3.3.1. Anxiety diagnosis

Students were asked if they have ever been diagnosed with anxiety by a healthcare or mental health professional. The examples provided for anxiety disorders were generalized anxiety, social anxiety, panic disorder, and specific phobia. Students who answered "yes" to this question were coded as having ever had an anxiety diagnosis.

3.3.2. Depression diagnosis

Students were asked if they have ever been diagnosed with depression by a healthcare or mental health professional. The examples provided for depressive disorders were major depression, persistent depressive disorder, and disruptive mood disorder. Students who answered "yes" to this question were coded as having ever had a depression diagnosis.

3.3.3. Race/ethnicity

Students were asked to indicate how they usually describe themselves from a list of race/ethnicity options. They were able to select one or multiple of the available options and/or write their own if their choice is not listed. The available choices were "American Indian or Native Alaskan," "Asian or Asian American," "Black or African American," "Hispanic or Latino/a/x," "Middle Eastern/North African (MENA) or Arab Origin," "Native Hawaiian or Other Pacific Islander Native," "White," "Biracial or Multiracial," and "My identity is not listed above (please specify)." The participants who selected multiple options were merged with those who selected "Biracial or Multiracial" into one group referred to in our analysis as "Multiracial." The self-identified groups were combined and referred to as the "Other" group.

3.3.4. Sociodemographic characteristics

In addition to race/ethnicity, we included age, gender, international student status, and year in school as the sociodemographic covariates for our analysis. We categorized age as young (18 to 24 year olds) and older adults (25+ year olds). We used self-reported gender. Students who selected "woman or female" were coded as women and those who selected "man or male" were coded as men. Students who selected other gender identities were combined into one group. International student status was considered positive if the participant answered "yes" to the question about whether they needed a visa to study or work in the United States. Year in school included 1, 2, 3, 4, or 5+.

3.4. Data analysis

We used STATA (StataCorp, 2021) for our analyses. Data cleanup was done by dropping observations with extreme measures on anthropometry (height, weight, and body mass index) variables on par with

other studies (Gnatiuc et al., 2019), but we did not exclude the observations with missing values on these variables (<0.6 % excluded). We also excluded participants with missing data on any of the predictors or outcomes that went into our models (6.1 % excluded). The final sample size was 65,568 undergraduate students in the U.S.

We ran a descriptive analysis of our sample and presented the proportions of each of our sociodemographic characteristics and presented the totals in Table 1. We also assessed the proportions of the investigated personal COVID-19 experiences (tested positive to COVID-19, lost a loved one to COVID-19, or faced increased financial hardship due to the COVID-19 pandemic) by the sociodemographic characteristics. We then ran a multiple logistic regression predicting the odds ratio of having experienced each of the investigated factors based on the participants' race/ethnicity. We controlled for the sociodemographic characteristics and the other COVID-19 experiences. The purpose of these models was to present the distribution of the three COVID-19 experiences across the different race groups. For this reason, we decided to control for the other COVID-19 experiences regardless of the directionality of association. Both the unadjusted and adjusted models predicting the odds ratios of the COVID-19 experiences are presented in Table 2. Finally, we ran a multiple logistic regression predicting psychological distress levels based on the three investigated personal experiences while controlling for race/ethnicity and basic sociodemographic characteristics. We have clustered standard errors by institution to account for the possibility that observations within the same institution might be correlated. We used a significance level of $p < 0.01$.

4. Results

Table 1 summarizes the sociodemographic characteristics of our sample ($N = 65,568$). 87.3 % of our sample of degree-seeking undergraduate students was 18 to 24 years old. 52.5 % were White, 15.4 % Hispanic, 13.7 % Asian, 3.1 % Black, 1 % Middle Eastern, 0.5 % American Indian, 0.3 % Native Hawaiian, and 12.7 % Multiracial. 68.2 % were women. Among the total sample, 6.1 % were international students. The distribution across the first 4 years of school was relatively similar with the third year compromising the majority at 26.5 %.

The distribution of our outcomes across the different subgroups is also presented in Table 1. Overall, 14.6 % of our sample had tested positive for COVID-19, 16.7 % had lost a loved one to COVID-19, and 63.3 % had experienced increased financial hardship due to the COVID-19 pandemic at the time that they completed the survey.

Table 2 summarizes the odds ratios of each of our predictors on having tested positive for COVID-19, having lost a loved one to COVID-19, or having experienced financial hardship due to the COVID-19 pandemic. There were no differences between the unadjusted and adjusted model; we therefore report the odds ratios from the adjusted model. Compared to White students, American Indian (OR: 1.25) and Hispanic (OR: 1.16) students had higher odds of having tested positive for COVID-19 while Asian (OR: 0.36, $p < 0.0001$), Black (OR: 0.65, $p < 0.0001$), Native Hawaiian (OR: 0.48), Multiracial (OR: 0.74, $p < 0.0001$), and Other (OR: 0.66, $p < 0.001$) groups had lower odds ratio of having tested positive to COVID-19. Compared to White students, all other racial/ethnic groups had significantly higher odds ratios of having lost a loved one to COVID-19 (OR range: 1.19–4.04, $p < 0.0001$ - < 0.01). All non-White groups showed significantly higher odds of having faced financial hardship due to COVID-19 than White students (OR range: 1.19–2.38, $p < 0.0001$ - < 0.01).

Table 3 summarizes the adjusted multiple logistic regression predicting psychological distress based on whether the participant had tested positive for COVID-19, experienced the death of a loved one due to COVID-19, or experienced increased financial hardship due to the COVID-19 pandemic (Block 1). Here, our adjusted model controls for race/ethnicity as well as other sociodemographic variables including age group, gender, international student status, and year in school (Block 2). The odds ratio of developing psychological distress was lower

Table 1

General demographic and key characteristics of our sample presented as total values and stratified by each of our predictors having tested positive for COVID-19, having lost a loved one to COVID-19, or having experienced financial hardship due to the COVID-19 pandemic, N (%).

Characteristic N (%)	Total	Tested positive to COVID-19		Death of a loved one due to COVID-19		Financial hardship due to COVID-19	
		No	Yes	No	Yes	No	Yes
	65,568 (100 %)	55,983 (85.4 %)	9585 (14.6 %)	54,639 (83.3 %)	10,929 (16.7 %)	24,038 (36.7 %)	41,530 (63.3 %)
Age group							
18–24	57,255 (87.3 %)	48,644 (86.9 %)	8611 (89.8 %)	48,253 (88.3 %)	9002 (82.4 %)	21,339 (88.8 %)	35,916 (86.5 %)
25+	8313 (12.7 %)	7339 (13.1 %)	974 (10.2 %)	6386 (11.7 %)	1927 (17.6 %)	2699 (11.2 %)	5614 (13.5 %)
Race							
American Indian	357 (0.5 %)	287 (0.5 %)	70 (0.7 %)	218 (0.4 %)	139 (1.3 %)	81 (0.3 %)	276 (0.7 %)
Asian	8970 (13.7 %)	8382 (15.0 %)	588 (6.1 %)	7803 (14.3 %)	1167 (10.7 %)	3324 (13.8 %)	5646 (13.6 %)
Black	2060 (3.1 %)	1828 (3.3 %)	232 (2.4 %)	1585 (2.9 %)	475 (4.3 %)	652 (2.7 %)	1408 (3.4 %)
Hispanic	10,089 (15.4 %)	8232 (14.7 %)	1857 (19.4 %)	6743 (12.3 %)	3346 (30.6 %)	2487 (10.3 %)	7602 (18.3 %)
Middle Eastern	645 (1.0 %)	552 (1.0 %)	93 (1.0 %)	487 (0.9 %)	158 (1.4 %)	210 (0.9 %)	435 (1.0 %)
Native Hawaiian	176 (0.3 %)	161 (0.3 %)	15 (0.2 %)	124 (0.2 %)	52 (0.5 %)	45 (0.2 %)	131 (0.3 %)
White	34,451 (52.5 %)	28,824 (51.5 %)	5627 (58.7 %)	30,411 (55.7 %)	4040 (37.0 %)	14,179 (59.0 %)	20,272 (48.8 %)
Multiracial	8346 (12.7 %)	7297 (13.0 %)	1049 (10.9 %)	6883 (12.6 %)	1463 (13.4 %)	2900 (12.1 %)	5446 (13.1 %)
Other	474 (0.8 %)	420 (0.7 %)	54 (0.6 %)	385 (0.7 %)	89 (0.8 %)	160 (0.7 %)	314 (0.8 %)
Gender							
Men	18,318 (27.9 %)	15,664 (28.0 %)	2654 (27.7 %)	15,870 (29.0 %)	2448 (22.4 %)	7931 (33.0 %)	10,387 (25.0 %)
Women	44,719 (68.2 %)	37,974 (67.8 %)	6745 (70.4 %)	36,580 (66.9 %)	8139 (74.5 %)	15,355 (63.9 %)	29,364 (70.7 %)
Other	2531 (3.9 %)	2345 (4.2 %)	186 (1.9 %)	2189 (4.1 %)	342 (3.1 %)	752 (3.1 %)	1779 (4.3 %)
International							
No	61,584 (93.9 %)	52,493 (93.8 %)	9091 (94.8 %)	51,341 (94.0 %)	10,243 (93.7 %)	22,680 (94.4 %)	38,904 (93.7 %)
Yes	3984 (6.1 %)	3490 (6.2 %)	494 (5.2 %)	3298 (6.0 %)	686 (6.3 %)	1358 (5.6 %)	2626 (6.3 %)
Year in school							
1st year undergraduate	15,798 (24.1 %)	13,444 (24.0 %)	2354 (24.6 %)	13,413 (24.5 %)	2385 (21.8 %)	6695 (27.9 %)	9103 (21.9 %)
2nd year undergraduate	13,925 (21.2 %)	11,824 (21.1 %)	2101 (21.9 %)	11,800 (21.6 %)	2125 (19.4 %)	5340 (22.2 %)	8585 (20.7 %)
3rd year undergraduate	17,400 (26.5 %)	14,913 (26.6 %)	2487 (25.9 %)	14,335 (26.2 %)	3065 (28.0 %)	5907 (24.6 %)	11,493 (27.7 %)
4th year undergraduate	13,742 (21.0 %)	11,719 (20.9 %)	2023 (21.1 %)	11,378 (20.8 %)	2364 (21.6 %)	4685 (19.5 %)	9057 (21.8 %)
5th year or more undergraduate	4703 (7.2 %)	4083 (7.4 %)	620 (6.5 %)	3713 (6.9 %)	990 (9.2 %)	1411 (5.8 %)	3292 (7.9 %)
Anxiety	19,136 (29.2 %)	16,385 (29.3 %)	2751 (28.7 %)	15,688 (28.7 %)	3448 (31.5 %)	5867 (24.4 %)	13,269 (32.0 %)
Depression	15,489 (23.6 %)	13,362 (23.9 %)	2127 (22.2 %)	12,696 (23.2 %)	2793 (25.6 %)	4496 (18.7 %)	10,993 (26.5 %)

in those who had tested positive for COVID-19 (OR: 0.82, $p < 0.0001$). Participants who had experienced the death of a loved one had higher odds of experiencing psychological distress (OR: 1.14, $p < 0.0001$) as did those students reporting increased financial hardship due to the COVID-19 pandemic (OR: 1.78, $p < 0.0001$).

5. Discussion

The objective of this study was to examine the rates of college students who tested positive for COVID-19, lost a loved one to COVID-19, and those who experienced hardship as well as the extent to which these were associated with their levels of psychological distress. We also sought to examine racial/ethnic differences in students' COVID-19 experiences. Among the over 65,000 undergraduate students whose responses to the Spring 2021 survey were included in our analysis, approximately 1 out of 7 had tested positive for COVID-19, 1 out of 6 had lost a loved one to COVID-19, and nearly 2 out of 3 reported facing financial hardship.

5.1. Racial disparities in COVID-19-related stressors

Our results reveal racial disparities in the COVID-19 experiences of these students. Compared to White students, Hispanic/Latinx students were 16 % more likely to test positive for COVID-19, while Asian, Black, and Native Hawaiian students were about 38–66 % less likely to test positive for COVID-19. These trends are consistent with the CDC data on COVID-19 (Centers for Disease Control and Prevention, 2021b) showing that Asian, Pacific Islander, and Black populations had around 215 daily cases per 100,000 population, while White and Hispanic populations had 242 and 474 daily cases per 100,000 population, respectively, during January 2021 (Centers for Disease Control and Prevention, 2021b). Recognizing that COVID-19 data on Middle Eastern populations is largely lacking or miscategorized as White (Alsharif, 2021; Department of Commerce, 2018), we disaggregated the data to examine this

group on its own. In doing so, we found that they were statistically no different than Whites in terms of testing positive for COVID-19.

Relative to White students, students from every racial/ethnic background had significantly higher odds of having lost a loved one to COVID-19, with American Indian and Hispanic students having almost 5 and 4 times the odds, respectively, of having lost a loved one to COVID-19 compared to White students. Assuming that the losses may be of loved ones from their own racial/ethnic background, our rates are consistent with the high death rates reported in racial minorities (Centers for Disease Control and Prevention, 2021b; Mude et al., 2021; UCLA Center for Health Policy, 2021; Willey et al., 2022). American Indian and Hispanic populations had peak daily death rates of about 10 and 7 per 100,000 population, respectively, while White populations had a peak daily death rate of about 6 per 100,000 population during Winter of 2020 (Centers for Disease Control and Prevention, 2021b).

While other data have demonstrated financial stress to be another point of disparity, with Latinx and Black students experiencing economic challenges due to the pandemic at higher rates than White students (Getachew et al., 2020), all the racial/ethnic minorities in our sample were more likely to experience increased financial hardship due to the pandemic compared to White students. Furthermore, we also disaggregated American Indian and Native Hawaiian students to be examined as a group on their own to better inform our understanding of their experiences during the pandemic (Taparra et al., 2021; Yom and Lor, 2021), especially given recent data showing that American Indians and Native Hawaiians represent some of the highest rates of COVID-19 incidence and mortality (UCLA Center for Health Policy, 2021). In our dataset, we found that along with Hispanic students, American Indian and Native Hawaiian students had approximately double the odds of facing financial hardship due to COVID-19 compared to White students. The results shown in our U.S. college student sample reflect the high rates of financial hardship reported in some of these racial/ethnic groups (Noe-Bustamante et al., 2021; Taparra et al., 2021). As well, international students were more likely to experience increased financial

Table 2

Multiple logistic regression models predicting the odds ratio of each of the COVID-19 experiences (having tested positive for COVID-19, having lost a loved one to COVID-19, or having experienced financial hardship due to the COVID-19 pandemic) across the different race groups.

Predictors	Unadjusted						Adjusted					
	Testing positive for COVID-19		Death of a loved one		Financial hardship		Testing positive for COVID-19		Death of a loved one		Financial hardship	
	OR	99 % CI	OR	99 % CI	OR	99 % CI	OR	99 % CI	OR	99 % CI	OR	99 % CI
Race (Ref: White)												
American Indian	1.249	(0.884–1.766)	4.800***	(3.497–6.587)	2.383***	(1.611–3.525)	1.224	(0.881–1.700)	4.040***	(2.968–5.500)	2.072***	(1.411–3.045)
Asian	0.360***	(0.285–0.453)	1.126	(0.954–1.329)	1.188*	(1.022–1.381)	0.342***	(0.269–0.434)	1.194*	(1.023–1.393)	1.305***	(1.143–1.491)
Black	0.650***	(0.510–0.830)	2.256***	(1.951–2.608)	1.510***	(1.294–1.764)	0.622***	(0.489–0.792)	2.172***	(1.886–2.502)	1.510***	(1.297–1.759)
Hispanic	1.156	(0.980–1.362)	3.735***	(3.365–4.146)	2.138***	(1.868–2.448)	1.059	(0.925–1.212)	3.444***	(3.110–3.815)	2.013***	(1.770–2.290)
Middle Eastern	0.863	(0.647–1.152)	2.442***	(1.860–3.206)	1.449*	(1.054–1.991)	0.807	(0.604–1.077)	2.408***	(1.834–3.161)	1.422*	(1.034–1.955)
Native Hawaiian	0.477	(0.208–1.097)	3.157**	(1.451–6.868)	2.036***	(1.375–3.016)	0.449*	(0.203–0.992)	2.950**	(1.351–6.441)	1.982***	(1.364–2.879)
Multiracial	0.736***	(0.648–0.837)	1.600***	(1.414–1.810)	1.313***	(1.194–1.445)	0.723**	(0.636–0.820)	1.578***	(1.401–1.776)	1.301***	(1.194–1.417)
Other	0.659**	(0.480–0.904)	1.740**	(1.134–2.670)	1.373*	(1.015–1.857)	0.687*	(0.508–0.929)	1.699*	(1.107–2.606)	1.394*	(1.038–1.871)
18–24 (Ref: 25+)							1.385***	(1.131–1.696)	0.722***	(0.657–0.794)	1.003	(0.846–1.188)
Gender (Ref: Men)												
Women							1.009	(0.893–1.141)	1.309***	(1.227–1.396)	1.329***	(1.247–1.416)
Other							0.456***	(0.351–0.593)	0.957	(0.805–1.136)	1.557***	(1.327–1.827)
International Student (Ref: Citizen/Resident)							1.004	(0.860–1.172)	0.987	(0.871–1.119)	1.127*	(1.007–1.262)
Year in school (Ref: First year)												
Second year							1.006	(0.910–1.112)	1.002	(0.917–1.095)	1.184***	(1.105–1.269)
Third year							0.964	(0.875–1.062)	1.071	(0.984–1.166)	1.371***	(1.266–1.484)
Fourth year							0.998	(0.892–1.117)	1.042	(0.949–1.143)	1.373***	(1.258–1.498)
Fifth year or more							0.930	(0.792–1.092)	1.140*	(1.022–1.273)	1.556***	(1.390–1.743)
Anxiety diagnosis							0.984	(0.896–1.082)	1.133***	(1.049–1.223)	1.182***	(1.109–1.260)
Depression diagnosis							0.900*	(0.821–0.987)	1.067	(0.978–1.163)	1.381***	(1.286–1.482)
Death of a Loved One to COVID-19							1.302***	(1.184–1.433)			1.652***	(1.527–1.786)
Financial Hardship due to COVID-19							1.167**	(1.051–1.295)	1.657***	(1.531–1.793)		
Tested Positive for COVID-19									1.299***	(1.179–1.430)	1.168**	(1.053–1.297)

*** p < 0.0001.
** p < 0.001.
* p < 0.01.

Table 3

Multiple logistic regression models predicting the odds ratio of having moderate-to-serious psychological distress based on the COVID-19 experiences – having tested positive for COVID-19, having lost a loved one to COVID-19, or having experienced financial hardship due to the COVID-19 pandemic. The adjusted model controls for race/ethnicity, age group, gender, international student status, and year in school.

Predictors	(1) Unadjusted		(2) Adjusted	
	OR	99 % CI	OR	99 % CI
Race (Ref: White)				
American Indian			0.863	(0.616–1.211)
Asian			1.707***	(1.561–1.866)
Black			1.085	(0.927–1.271)
Hispanic			1.201***	(1.093–1.320)
Middle Eastern			1.877***	(1.384–2.545)
Native Hawaiian			1.283	(0.813–2.026)
Multiracial			1.279***	(1.165–1.405)
Other			1.285	(0.975–1.695)
18–24 (Ref: 25+)			1.866***	(1.688–2.062)
Gender (Ref: Men)				
Women			1.363***	(1.273–1.459)
Other			4.649***	(3.611–5.985)
International Student (Ref: Citizen/ Resident)			0.948	(0.849–1.058)
Year in school (Ref: First year undergraduate)				
Second year undergraduate			1.023	(0.937–1.116)
Third year undergraduate			0.968	(0.902–1.038)
Fourth year undergraduate			0.826***	(0.757–0.902)
Fifth year or more undergraduate			0.962	(0.843–1.097)
Anxiety diagnosis			2.178***	(2.001–2.370)
Depression diagnosis			2.915***	(2.578–3.295)
Tested Positive to COVID-19	0.780***	(0.714–0.852)	0.818***	(0.757–0.885)
Death of a Loved One to COVID-19	1.146***	(1.058–1.241)	1.143***	(1.060–1.233)
Financial Hardship due to COVID-19	1.940***	(1.834–2.052)	1.780***	(1.692–1.871)

*** p < 0.0001.

hardship due to the pandemic. This was expected given the minimal financial support provided to international students. For example, international students are not eligible for U.S. government-funded financial aid (Homeland Security, 2022).

5.2. COVID-19-related stressors and psychological distress

We examined whether contracting COVID-19, losing a loved one to COVID-19, or increased financial hardship was associated with students' psychological distress while accounting for the effects of race/ethnicity and other sociodemographic factors. Among these three experiences, increased financial hardship showed the highest association with psychological distress, roughly doubling the likelihood that a student reported moderate-to-serious psychological distress. Losing a loved one to COVID-19 was also associated with more modest elevated odds of psychological distress, but interestingly, contracting COVID-19 was associated with significantly less psychological distress.

The association between increased financial hardship and psychological distress is in line with previous findings suggesting financial stress is a major contributor to mental health concerns among U.S. college students and young adults (Archuleta et al., 2013; Birmingham et al., 2021; Liu et al., 2022; The Harris Poll, 2021; Tran et al., 2018). The association between having lost a loved one and higher odds of psychological distress was also expected given the significant impact of

bereavement on the mental health of students (Balk, 2008; Valentine and Woodthorpe, 2020). Indeed, previous findings have shown that students may be more vulnerable to the effects of bereavement than older adults (Valentine and Woodthorpe, 2020). During COVID-19, many college students reported that stress of losing a loved one was the most significant factor affecting their mental health (Lee et al., 2021). Bereavement is a normal response to loss and should not be disabling nor should it cause significant dysfunction as would be seen in severe psychological distress (Zisook and Shear, 2009). Still, bereavement has been shown to have a significant impact on students' mental health and cognitive skills as they cope with intensely painful emotions and may experience a significant drop in academic performance (Balk, 2008; Servaty-Seib and Hamilton, 2006; Valentine and Woodthorpe, 2020).

Interestingly, according to our analysis, students who tested positive for COVID-19 appear to be at lower risk of psychological distress, and this was true even after controlling for participant's age, race, gender, international student status, year of school, and endorsement of either of the other two experiences. This is in contrast to previous literature that suggests worse mental health outcomes in COVID-19 patients (Mohammadian Khonsari et al., 2021; Rodríguez-Rey et al., 2020; Taquet et al., 2021). It is possible that some of the students who tested positive were asymptomatic, as previous data on those who are regularly tested indicate that about half of those who are SARS-CoV-2 positive may be asymptomatic (Oran and Topol, 2020). Such asymptomatic cases may be more prevalent than in the general population since many schools implemented policies for consistent testing among their students. That said, even among the symptomatic cases, COVID-19 is in general less severe among young adults compared to the general population (Centers for Disease Control and Prevention, 2021a), and thus the experience of having COVID-19 may be less distressing psychologically for young people. Students who tested positive may consider themselves resilient for having overcome the condition. In a longitudinal study assessing the mental health of college students during the COVID-19 pandemic, Li et al. found students are worrying less about getting infected as the pandemic progresses (Li et al., 2021b). Additionally, being ill is perhaps a shorter-term concern for young people relative to the long-term grief of losing a family member or the uncertainty and chronicity of financial stress. Taken together, the conditions which endure and reflect greater uncertainty over time could have a greater psychological impact on college students.

The association between testing positive for COVID-19 and reporting lower psychological distress might also be confounded by protective factors inherent in the characteristics of the students who tested positive compared to those who did not. It could be that students who tested positive were more likely to be part of college activity groups like varsity sports, intramural sports, or fraternities/sororities. Being part of an activity group might be protective; Edwards et al. found in their study of about half a million college students from 2011 to 2019 that self-reported anxiety and mood disorder symptoms were lower in student athletes than in non-athletes (Edwards et al., 2021).

6. Limitations

These results must be interpreted within the context of the study design, and several limitations exist. First, despite institutions requiring that either all students or a random subset be invited to participate in the survey, there may be systematic differences between the students who elect to participate and those who do not. As well, institutions can self-select to participate in the ACHA-NCHA. These two factors may introduce sampling bias. The lack of non-response data limits weighting techniques. Second, due to the nature of the national survey upon which our analysis was conducted, all measures are self-reported, and therefore susceptible to recall bias and misinterpretation. Third, since this is a cross-sectional study, all of the exposure and outcome variables were measured simultaneously. Hence, directionality and causality of

associations cannot be assessed. Prospective studies are required to assess causation. Fourth, there may be other stressors that college students experienced that were not captured in this analysis. For example, some other stressors include being placed in quarantine, prolonged use of social media, substance use, and having social support. Fifth, participants who identified with more than one race/ethnicity were coded as multiracial. Due to the many different possibilities for what that category could represent, the multiracial group might be too heterogenous for a generalizable result. As well, there may be racially mixed individuals who did not choose to identify as multiracial. Furthermore, formal categorization or how one self-identifies can change over time. Finally, American Indian, Middle Eastern, Native Hawaiian, and 'Other' race groups each represented 1 % or less of the total sample size. This might make their analyses underpowered. Data on college students should seek to include greater numbers of participants particularly from underrepresented groups so that future research can be powered to address disparities due to the pandemic.

7. Conclusion/implication

Our results highlight the importance of understanding the relative effects of different pandemic-related factors on college students' well-being. Our results further highlight the inequitable burden of certain COVID-19 experiences on racial minority groups. Regardless of the direct physical effects of COVID-19, it seems that indirect psychosocial and emotional effects of losing loved ones and/or facing financial hardships might exert a significant harmful impact on students' mental health.

Consideration of these experiences is warranted as colleges attempt to allocate attention and resources to support the well-being of U.S. college students during the pandemic. For instance, universities' support of their bereaved students can play a role in reducing their mental health concerns (Valentine and Woodthorpe, 2020). One such example is an "in memoriam" page set up by City University of New York (CUNY) to memorialize faculty, staff, students, alumni, and retirees who have passed away (City University of New York, 2022; Herder, 2021). CUNY's approach differs in that it set up a page to remember members and students of their school while our results imply the need to support students who lost loved ones. Even so, CUNY's approach is a step in the right direction.

Our data also suggest the importance of continued and enhanced financial support for college students. One such example is Boston University's food pantry program that aims to end food insecurity for all of their students (Boston University, 2022). Another example is The Steve Fund that is dedicated to improving the mental health of students of color through different colleges and universities (Chavous and Primm, 2020). Meanwhile, contracting COVID-19 itself may not be a source of significant distress for students. Institutions should consider the relative impact of the different experiences college students are going through when prioritizing their support programs. As well, efforts should be made to ensure equitable access to institutions' resources and support services across students of all races and ethnicities.

Funding sources

IRB approval status

This analysis was exempt from human subjects review according to the Institutional Review Board of Mass Brigham General.

Reprint requests

Cindy H. Liu, Ph.D.

Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

CRediT authorship contribution statement

Abdelrahman ElTohamy: Data curation, Methodology, Writing-Original draft preparation.
Sunah Hyun: Conceptualization, Data curation.
Anjeli R. Macaranas: Writing - Original draft preparation.
Justin A. Chen: Writing - Reviewing and Editing.
Courtney Stevens: Writing - Reviewing and Editing.
Cindy H. Liu: Supervision, Writing - Reviewing and Editing, Resources, Funding acquisition.

Conflict of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

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Paper 2: Association Between College Course Delivery Model and Psychological Distress

ElTohamy, A., Wang, J. J., Chen, J. A., Stevens, C., & Liu, C. H. (2022). Association Between

College Course Delivery Model and Rates of Psychological Distress During the COVID-19

Pandemic. *JAMA Network Open*, *5*(11), e2244270.

https://doi.org/10.1001/jamanetworkopen.2022.44270

Association Between College Course Delivery Model and Rates of Psychological Distress During the COVID-19 Pandemic

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Abstract

IMPORTANCE College students in the US have been heavily affected by the COVID-19 pandemic. In addition to increased rates of depression and anxiety, college students have faced unprecedented stressors, such as geographic relocation and abrupt conversion from in-person classes to online classes.

OBJECTIVE To study the association between course delivery model and psychological distress among US college students.

DESIGN, SETTING, AND PARTICIPANTS This cross-sectional analysis used national data from the American College Health Association–National College Health Assessment III data set. Data were gathered from a web-based survey administered from January to early June 2021 to full-time US college students attending 4-year programs.

EXPOSURE Course delivery model was self-reported.

MAIN OUTCOMES AND MEASURES Psychological distress was measured using the Kessler Screening Scale for Psychological Distress.

RESULTS This study evaluated 59 250 full-time undergraduate students (68.1% women; 51.5% White students; mean [SD] age, 21.2 [4.3] years); 3.5% attended fully in-person classes, 61.2% attended fully online classes, and 35.3% attended a mixed format of in-person and online classes. Students who attended classes fully online reported higher levels of psychological distress than those who attended a mix of online and in-person classes (b = 0.76 [99% CI, 0.64-0.88]; P < .001). This association remained significant after controlling for geographic region, year in school, gender, race and ethnicity, food security, current anxiety and/or depressive disorders, COVID-19 concerns, and residence (living on campus, off campus with family, or other off-campus arrangements) (b = 0.18 [99% CI, 0.04-0.31]; P = .001), as well as time spent socializing with friends (b = 0.13 [99% CI, 0.002-0.26]; P = .009).

CONCLUSIONS AND RELEVANCE The findings of this study suggest that mental health professionals may wish to consider the association of course delivery models with mental health outcomes when working with college students. Colleges should be aware of the mental health burden associated with attending fully online classes and consider possible in-person components and supports for students.

Key Points

Question Is course delivery model (entirely online vs mix of online and in-person classes) associated with college students' mental health?

Findings In this cross-sectional study of a nationwide data set that included 59 250 full-time undergraduate students, those attending fully online classes reported higher levels of psychological distress than students attending a mix of online and in-person classes.

Meaning The findings of this study suggest that educational institutions and policy makers should weigh the risks and benefits when making determinations regarding school setting and transitions to online classes.

➕ **Supplemental content**

Author affiliations and article information are listed at the end of this article.

Introduction

College students worldwide are facing unprecedented stressors brought about by the COVID-19 pandemic.[1,2] Many college students have endured the loss of a loved one, faced financial hardships, or experienced racial discrimination during the pandemic.[3] Rates of depression and anxiety among US college students have increased markedly, with 6 of every 10 college students reporting symptoms of anxiety or depression during the pandemic.[2,4] Compared with before the pandemic, the prevalence of depressive symptoms among US adults aged 18 to 39 years old during the pandemic more than quadrupled by April 2020.[5] In addition, most US college students had to relocate from their college campuses[1] within weeks from the declaration of the pandemic.[6] A Pew Research Center analysis indicated that between February and July 2020, 2.1 million young adults between 18 and 24 years of age moved back in with their parents.[7]

Concomitant shifts in the learning environment during the pandemic, such as the transition to virtual classes, also altered course delivery models and structures.[8] During the fall of 2020, 43% of 4-year colleges had fully online classes, 34% included a mix of in-person and online classes, and 13% had fully in-person classes.[9] Challenges faced by college students in remote learning environments include limited internet or technology access, with negative consequences on academic performance.[10] Challenges also include the loss of student experiences, such as extracurricular activities, internships, trips to study abroad, service learning, and social events.[10] The deprivation of these milestone events, as well as the loss of normalcy, friendships, and connection with others, may contribute to personal distress.[11] In addition, those taking courses online may include students living at home during the first year of the pandemic. Students' residence—whether with peers or family—may predispose them to different socialization experiences or levels of distress. There is ample evidence that socializing with others is critical for supporting both mental and physical health.[12,13] However, many mental health professionals may fail to consider the association of such social determinants with mental health outcomes in their clinical approach.[14]

The association between fully online classes and psychological distress—the set of cognitive, emotional, and behavioral symptoms associated with mental health disorders[15]—remains understudied among college students, to our knowledge. One small cross-sectional survey including fewer than 200 participants showed that most college students had difficulties adjusting to online learning and focusing on academic work during the pandemic and that academic challenges were associated with higher rates of depression and anxiety.[16] Of the studies that have been conducted on the association of online learning with student outcomes, most focused on academic outcomes.[17,18] To our knowledge, there are no large-scale studies before or during the COVID-19 pandemic that have examined the association between course delivery model (entirely online vs mix of online and in-person classes) and college students' mental health.

To address this gap, our study analyzed a nationwide sample of undergraduate students in the US from spring 2021 to measure the prevalence of college students who were engaged in course delivery models that were online only, in-person only, and mixed (online and in-person). We examined whether students attending online classes reported higher rates of psychological distress compared with students attending mixed online and in-person classes.

Methods

Data Source and Sample

This cross-sectional study was based on the American College Health Association–National College Health Assessment III (ACHA-NCHA),[19] a biannual survey administered to students in higher educational institutions across the US. The ACHA-NCHA requires institutions either to have all students respond or to randomly select a sample of students. The spring 2021 survey, administered from January to early June 2021, was entirely web-based and included demographic data, psychometric scales, and COVID-19–related questions. Our analysis was based on 59 250 full-time

undergraduate students attending 4-year US colleges or universities during spring 2021 with data available on all measures as described. This study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline for reporting observational studies.[20] The use of this existing and deidentified data set from the ACHA was approved as an expedited application through the institutional review board at Mass General Brigham. The institutional review board of Mass General Brigham deemed this analysis exempt from human participants review as it used deidentified data from the ACHA-NCHA. Participant consent was first implied when participants clicked on the link within an email message to access the survey, with procedures approved by the institutional review board of the students' institution. Second, participants were presented with information and instructions on the first page of ACHA-NCHA, including that by clicking "Begin Survey," they consented to participate in the survey.

Measures

Exposures: Course Delivery Model and Place of Residence

The course delivery model variable was assessed using the following question: "I am taking classes this term," with response options of "entirely in-person," "entirely online," or "a mix of in-person and online classes." The place of residence was assessed using the following question: "Where do you currently live?" Students who answered "in a fraternity or sorority residence" or "campus or university housing" were coded as the on-campus group. Those who answered "parent/guardian/ other family member's home" were coded as the off-campus with family group. Students who answered "off-campus or other non-university housing" were coded as the other off-campus arrangements group.

Outcome: Psychological Distress

Psychological distress was measured using the Kessler Screening Scale for Psychological Distress.[15] The scale consists of 6 questions, each of which starts with, "During the past 30 days, about how often did you feel…" The questions asked about one's experience of being "nervous," "hopeless," "restless or fidgety," "so sad nothing could cheer you up," "that everything was an effort," and "worthless." Each question was answered on a 5-point Likert scale, where 0 indicated "none of the time" and 4 indicated "all of the time," with a total score range of 0 to 24. Higher scores correspond to greater psychological distress. In line with previous studies,[21,22] psychological distress was examined as a continuous variable in our analysis. The Cronbach α for these items in our sample was 0.89, indicating good reliability.

Covariates

A detailed description of our covariates (sociodemographic characteristics, current anxiety and/or depressive disorders, socializing time, and COVID-19 concerns) can be found in the eAppendix in the Supplement.

Statistical Analysis

We used Stata, version 17 (StataCorp LLC) for our data analysis.[23] In line with previous research,[3,24] data cleaning was performed by removing observations with scores outside the plausible range for height (<47.2 inches [120 cm] or >94 inches [239 cm]), weight (<75 lb [34 kg] or >600 lb [272 kg]), and body mass index (>80; calculated as weight in kilograms divided by height in meters squared). Participants who reported not currently having a place to live or temporarily staying with a friend were removed from the analysis (0.1% excluded). Participants with missing data on any of the variables used in the final model were also excluded (5.2% excluded). The resulting sample size was 59 250 full-time undergraduate students in 4-year US colleges or universities. This sample was used for our descriptive analysis in **Table 1**.

Students attending entirely in-person classes were excluded from the regression analyses given their small sample size (n = 2075 [3.5%]). The sample size for our regression analyses was 57 175

Table 1. General Demographic and Key Characteristics of the Sample

Characteristic	Students, No. (%)[a]						
		Course delivery model[b]			Residence[b]		
	Total (N = 59 250 [100%])	In person (n = 2075 [3.5%])	Online (n = 36 273 [61.2%])	Mixed (n = 20 902 [35.3%])	On campus (n = 16 887 [28.5%])	Off campus with family (n = 22 074 [37.3%])	Other off-campus arrangements (n = 20 289 [34.2%])
Region							
Northeast	6932 (11.7)	293 (14.1)	4070 (11.2)	2569 (12.3)	2809 (16.6)	2404 (10.9)	1719 (8.5)
Midwest	13 684 (23.1)	863 (41.6)	4431 (12.2)	8390 (40.1)	6940 (41.1)	1994 (9.0)	4750 (23.4)
South	5304 (9.0)	472 (22.7)	1494 (4.1)	3338 (16.0)	2203 (13.0)	864 (3.9)	2237 (11.0)
West	33 330 (56.3)	447 (21.5)	26 278 (72.4)	6605 (31.6)	4935 (29.2)	16 812 (76.2)	11 583 (57.1)
Age, mean (SD), y	21.2 (4.3)	20.6 (2.9)	21.6 (4.8)	20.6 (3.3)	19.7 (2.0)	20.7 (3.0)	23.0 (5.9)
Current anxiety disorder	11 690 (19.7)	368 (17.7)	6623 (18.3)	4699 (22.5)	3618 (21.4)	3275 (14.8)	4797 (23.6)
Current depressive disorder	9445 (15.9)	264 (12.7)	5441 (15.0)	3740 (17.9)	2874 (17.0)	2613 (11.8)	3958 (19.5)
COVID-19 concerns, mean (SD)[c]	14.0 (5.8)	11.7 (5.8)	14.7 (5.7)	12.9 (5.7)	13.1 (5.6)	14.8 (5.7)	13.9 (5.8)
Race and ethnicity							
American Indian	260 (0.4)	16 (0.8)	139 (0.4)	105 (0.5)	75 (0.4)	74 (0.3)	111 (0.5)
Asian	8804 (14.9)	130 (6.3)	7030 (19.4)	1644 (7.9)	1634 (9.7)	4976 (22.5)	2194 (10.8)
Black	1857 (3.1)	46 (2.2)	1198 (3.3)	613 (2.9)	665 (3.9)	667 (3.0)	525 (2.6)
Hispanic	9061 (15.3)	78 (3.8)	7767 (21.4)	1216 (5.8)	1181 (7.0)	5764 (26.1)	2116 (10.4)
Middle Eastern	598 (1.0)	6 (0.3)	494 (1.4)	98 (0.5)	85 (0.5)	361 (1.6)	152 (0.7)
Multiracial	7634 (12.9)	182 (8.8)	5218 (14.4)	2234 (10.7)	2064 (12.2)	2976 (13.5)	2594 (12.8)
Native Hawaiian	145 (0.2)	2 (0.1)	118 (0.3)	25 (0.1)	20 (0.1)	89 (0.4)	36 (0.2)
White	30 490 (51.5)	1602 (77.2)	14 042 (38.7)	14 846 (71.0)	11 062 (65.5)	7003 (31.7)	12 425 (61.2)
Other[d]	401 (0.7)	13 (0.6)	267 (0.7)	121 (0.6)	101 (0.6)	164 (0.7)	136 (0.7)
Gender							
Men	16 642 (28.1)	694 (33.4)	9588 (26.4)	6360 (30.4)	5138 (30.4)	5859 (26.5)	5645 (27.8)
Women	40 327 (68.1)	1334 (64.3)	25 261 (69.6)	13 732 (65.7)	10 980 (65.0)	15 448 (70.0)	13 899 (68.5)
Other	2281 (3.8)	47 (2.3)	1424 (3.9)	810 (3.9)	769 (4.6)	767 (3.5)	745 (3.7)
International student	3522 (6.1)	87 (4.3)	2422 (6.9)	1013 (5.0)	969 (6.0)	1465 (6.8)	1088 (5.5)
Year in school							
First	14 753 (24.9)	540 (26.0)	8332 (23.0)	5881 (28.1)	7452 (44.1)	5983 (27.1)	1318 (6.5)
Second	12 822 (21.6)	466 (22.5)	7239 (20.0)	5117 (24.5)	4400 (26.1)	4687 (21.2)	3735 (18.4)
Third	15 984 (27.0)	457 (22.0)	10 365 (28.6)	5162 (24.7)	3016 (17.9)	5922 (26.8)	7046 (34.7)
Fourth	12 267 (20.7)	541 (26.1)	7818 (21.6)	3908 (18.7)	1830 (10.8)	3979 (18.0)	6458 (31.8)
Fifth or more	3424 (5.8)	71 (3.4)	2519 (6.9)	834 (4.0)	189 (1.1)	1503 (6.8)	1732 (8.5)
Food security							
High	37 973 (64.1)	1385 (66.7)	23 508 (64.8)	13 080 (62.6)	10 641 (63.0)	15 589 (70.6)	11 743 (57.9)
Low	14 953 (25.2)	509 (24.5)	8832 (24.3)	5612 (26.8)	4507 (26.7)	4800 (21.7)	5646 (27.8)
Very low	6324 (10.7)	181 (8.7)	3933 (10.8)	2210 (10.6)	1739 (10.3)	1685 (7.6)	2900 (14.3)
Socializing time (h/wk)							
Low (0)	5657 (9.5)	70 (3.4)	4459 (12.3)	1128 (5.4)	771 (4.6)	3136 (14.2)	1750 (8.6)
Medium (1-5)	24 350 (41.1)	677 (32.6)	16 268 (44.8)	7405 (35.4)	5309 (31.4)	10 916 (49.5)	8125 (40.0)
High (≥6)	29 243 (49.4)	1328 (64.0)	15 546 (42.9)	12 369 (59.2)	10 807 (64.0)	8022 (36.3)	10 414 (51.3)
Place of residence							
On campus	16 887 (28.5)	1287 (62.0)	5101 (14.1)	10 499 (50.2)	NA	NA	NA
Off campus with family	22 074 (37.3)	146 (7.0)	19 290 (53.2)	2638 (12.6)	NA	NA	NA
Other off-campus arrangements	20 289 (34.2)	642 (30.9)	11 882 (32.8)	7765 (37.1)	NA	NA	NA
Course delivery model							
In-person	2075 (3.5)	NA	NA	NA	1287 (7.6)	146 (0.7)	642 (3.2)
Online	36 273 (61.2)	NA	NA	NA	5101 (30.2)	19 290 (87.4)	11 882 (58.6)
Mixed	20 902 (35.3)	NA	NA	NA	10 499 (62.2)	2638 (12.0)	7765 (38.3)

Abbreviation: NA, not applicable.

[a] Percentages may not total 100% because of rounding.

[b] The χ² test and analysis of variance examining characteristics by course delivery model and by residence showed an overall statistically significant difference in distribution (P < .001).

[c] COVID-19 concerns scale is composed of 6 items. Each item was measured on a 5-point Likert scale, where 0 indicated "not concerned at all" and 4 indicated "extremely concerned," with a total score range from 0 to 24.

[d] Students who indicated that their racial or ethnic identity is not listed were recoded as "Other."

students, comprising those who attended fully online classes and those who attended mixed online and in-person classes. The first linear regression model examined psychological distress as an outcome based on course delivery model as an independent variable (block 1). The second model adjusted for covariates through a multiple linear regression analysis (block 2). The third model included the socialization variable (block 3) (Table 1). A simple linear regression model was used for **Table 2** block 1. Multiple linear regression models were used for Table 2 blocks 2 and 3. All statistical tests were 2-sided. Consistent with prior published research using ACHA-NCHA data,[25] a significance level of $P < .01$ and 99% CIs were used given the large sample size and number of comparisons being made.

Results

This study evaluated 59 250 full-time undergraduate students (68.1% women; 51.5% White students; mean [SD] age, 21.2 [4.3] years). Table 1 summarizes the general demographic and key characteristics of the full sample. More than half the participants (64.1%) reported a high level of food security. Almost one-fifth of the participants (19.7%) reported having a current anxiety disorder, and 15.9% reported having a current depressive disorder.

Of the 59 250 participants in our sample, 3.5% attended fully in-person classes, 61.2% attended fully online classes, and 35.3% attended a mixed format of in-person and online classes. Of the 59 250 participants, 28.5% lived on campus, 37.3% lived off campus with family, and 34.2% lived in other off-campus arrangements. About half the college students (49.4%) reported socializing 6 or more hours a week, while 41.1% of students spent 1 to 5 hours a week socializing. A total of 9.5% of students reported spending 0 hours a week socializing with friends. These rates appear to vary widely based on the various course delivery models. Students attending online-only classes had the lowest socialization levels, with 12.3% of students reporting no socializing compared with 5.4% of students attending mixed format classes and 3.4% of students attending fully in-person classes.

Table 2 presents results of the linear regression models with psychological distress as an outcome and course delivery model as an independent variable (online-only vs mixed-format classes). Compared with the students attending mixed-format classes, those who attended fully online classes reported greater distress (b = 0.76 [99% CI, 0.64-0.88]; $P < .001$; block 1). This association remained significant after controlling for region, year in school, gender, race and ethnicity, food security, current anxiety and/or depressive disorders, COVID-19 concerns, and place of residence (b = 0.18 [99% CI, 0.04-0.31]; $P = .001$; block 2). Even when controlling for socializing time, the association between attending classes online and increased distress levels remained significant (b = 0.13 [99% CI, 0.002-0.26]; $P = .009$; block 3).

Students who lived in other off-campus arrangements reported less distress (b = −0.54 [99% CI, −0.69 to −0.39]; $P < .001$; block 2) relative to those who lived on-campus; this association remained significant after controlling for socializing time (b = −0.61 [99% CI, −0.76 to −0.46]; $P < .001$; block 3). Students who lived off campus with family reported more distress (b = 0.30 [99% CI, 0.14-0.45]; $P < .001$; block 2) relative to those who lived on campus, but this association did not remain significant after controlling for socializing time (b = 0.12 [99% CI, −0.03 to 0.28]; $P = .04$; block 3) (Table 2).

Discussion

Most (61.2%) of the 59 250 US college students in our sample attended classes fully online, 35.3% attended a mixed format of in-person and online classes, and 3.5% attended fully in-person classes. Based on our analyses, it appears that students whose classes were offered entirely online were at risk for increased psychological distress compared with those attending a mix of in-person and online classes. This association remained significant even after controlling for geographic region and a wide

Table 2. Linear Regression Model With Psychological Distress as an Outcome and Course Delivery Model as an Independent Variable (Online Only vs Mixed Format)[a]

Variable	Block 2[b]			Block 3[c]		
	Unstandardized coefficient (99% CI)	Standardized β coefficient	P value	Unstandardized coefficient (99% CI)	Standardized β coefficient	P value
Region						
Northeast	0 [Reference]	0	NA	0 [Reference]	0	NA
Midwest	−0.03 (−0.22 to 0.17)	−0.002	.72	0.002 (−0.19 to 0.19)	0.000	.98
South	−0.20 (−0.44 to 0.04)	−0.01	.04	−0.164 (−0.403 to 0.075)	−0.008	.08
West	0.114 (−0.06 to 0.29)	0.01	.09	0.07 (−0.10 to 0.24)	0.006	.30
Year in school						
First	0 [Reference]	0	NA	0 [Reference]	0	NA
Second	0.06 (−0.10 to 0.21)	0.004	.33	0.08 (−0.08 to 0.24)	0.006	.18
Third	−0.27 (−0.43 to −0.12)	−0.02	<.001	−0.28 (−0.43 to −0.13)	−0.02	<.001
Fourth	−0.60 (−0.76 to −0.43)	−0.04	<.001	−0.60 (−0.76 to −0.43)	−0.04	<.001
Fifth or more	−0.56 (−0.81 to −0.31)	−0.02	<.001	−0.65 (−0.89 to −0.40)	−0.03	<.001
Gender						
Men	0 [Reference]	0	NA	0 [Reference]	0	NA
Women	0.47 (0.35 to 0.589)	0.04	<.001	0.45 (0.33 to 0.57)	0.04	<.001
Other	2.60 (2.31 to 2.88)	0.09	<.001	2.57 (2.28 to 2.85)	0.09	<.001
Race and ethnicity						
White	0 [Reference]	0	NA	0 [Reference]	0	NA
American Indian	−0.002 (−0.80 to 0.80)	0.000	.995	−0.18 (−0.98 to 0.62)	−0.002	.56
Asian	0.70 (0.54 to 0.86)	0.05	<.001	0.68 (0.52 to 0.84)	0.04	<.001
Black	0.04 (−0.27 to 0.34)	0.001	.76	−0.11 (−0.42 to 0.19)	−0.004	.33
Hispanic	−0.11 (−0.28 to 0.05)	−0.007	.08	−0.23 (−0.40 to −0.07)	−0.02	<.001
Middle Eastern	1.35 (0.83 to 1.87)	0.03	<.001	1.30 (0.78 to 1.82)	0.02	<.001
Multiracial	0.39 (0.22 to 0.55)	0.02	<.001	0.35 (0.18 to 0.51)	0.02	<.001
Native Hawaiian	0.15 (−0.90 to 1.19)	0.001	.72	0.10 (−0.95 to 1.14)	0.001	.81
Other[d]	0.32 (−0.32 to 0.96)	0.005	.20	0.15 (−0.48 to 0.79)	0.002	.54
Food security						
High	0 [Reference]	0	NA	0 [Reference]	0	NA
Low	1.52 (1.39 to 1.64)	0.12	<.001	1.51 (1.39 to 1.64)	0.12	<.001
Very low	3.16 (2.99 to 3.34)	0.18	<.001	3.12 (2.94 to 3.29)	0.18	<.001
Current anxiety disorder	1.03 (0.84 to 1.22)	0.08	<.001	1.05 (0.86 to 1.24)	0.08	<.001
Current depressive disorder	2.76 (2.56 to 2.97)	0.18	<.001	2.72 (2.51 to 2.93)	0.18	<.001
COVID-19 concerns	0.25 (0.24 to 0.26)	0.26	<.001	0.25 (0.24 to 0.25)	0.26	<.001
Place of residence						
On campus	0 [Reference]	0	NA	0 [Reference]	0	NA
Off campus with family	0.30 (0.14 to 0.45)	0.03	<.001	0.12 (−0.03 to 0.28)	0.01	.04
Other off-campus arrangements	−0.54 (−0.69 to −0.39)	−0.05	<.001	−0.61 (−0.76 to −0.46)	−0.05	<.001
Course delivery model						
Mixed	0 [Reference]	0	NA	0 [Reference]	0	NA
Online	0.18 (0.04 to 0.31)	0.02	.001	0.13 (0.002 to 0.26)	0.01	.009
Socializing time						
Low	NA	NA	NA	0 [Reference]	0	NA
Medium	NA	NA	NA	−1.18 (−1.37 to −0.99)	−0.11	<.001
High	NA	NA	NA	−1.73 (−1.92 to −1.55)	−0.16	<.001
R^2	0.229			0.237		

Abbreviation: NA, not applicable.

[a] Block 1 was unadjusted (course delivery model variable only). The unstandardized coefficient for online-only relative to mixed format was 0.76 (99% CI, 0.64-0.88), with a standardized β coefficient of 0.07 (P < .001) and R^2 = 0.004.

[b] Adjusted (course delivery model and all single variables except socializing time).

[c] Adjusted (course delivery model, all single variables, and socializing time).

[d] Students who indicated that their racial or ethnic identity is not listed were recoded as "Other."

range of sociodemographic characteristics, as well as when controlling for students' reported amount of time spent socializing with friends.

Why might a course delivery model with some in-person experiences be more beneficial than a fully online course delivery model? First, the culture of student life is significantly altered with an online-only format, whereas some degree of normalcy may be preserved with a mixed format that includes at least some in-person experiences. The COVID-19 pandemic's negative association with school culture formation was a frequently reported concern in a qualitative study of 43 primary and secondary school educators.[26] Socializing with friends was likely more challenging for those who attended classes only online, as such engagement requires greater intentionality and effort. In contrast, a mixed format still afforded at least some in-person experiences that students were accustomed to, with informal opportunities for social interaction. Relatedly, those who attended classes only online were likely to have altered, limited, or no opportunities for participating in extracurricular activities.[27] Students who attended classes in a mixed format might also have had the choice of attending online or in-person, affording students the flexibility of attending in the format that is most convenient on any particular day.[28] Such increased perceived control could also help mitigate the negative effect of stressful situations.[29]

Second, students who attended classes only online may have experienced greater distress from academic challenges.[30-32] Factors other than socialization were likely at play given that the association between course delivery model and psychological distress holds even after controlling for reported socializing time. A 2022 mixed-methods study observed that college and graduate students found it challenging to engage during online classes.[33] Some of the challenges reported included feeling distracted and procrastinating.[33] Students may experience decreased motivation to engage with faculty when attending class fully online compared with when there is an opportunity for face-to-face interactions.[34] Online classes may be held asynchronously, which might also increase the burden of time management, as students would be expected to go through course content on their own.[34] Teaching methods were likely altered in the transition to online formats; changes in teaching methods were found to be a major source of academic-related frustration among college students during the pandemic.[35]

The shift to online classes was intended to limit in-person contact via social distancing,[36,37] a key strategy for mitigating COVID-19 transmission.[38] Despite the protections for physical health afforded by these strategies, our results suggest that fully online classes could be associated with worse mental health. Although a mixed format could present additional logistical complications for educators, our findings suggest that some amount of in-person instructional time may be protective for students' mental health.

Although our primary study aim was to investigate the association between course delivery model and psychological distress, our secondary analyses revealed an association between students' place of residence and psychological distress. Students who lived in other off-campus arrangements reported lower levels of psychological distress compared with those who lived on campus. After accounting for socializing time, students living off campus with family did not report different psychological distress levels than those who lived on campus. This finding addresses the current literature that shows mixed findings on the protective or harmful associations between living with family and the mental health of college students. Lee et al[2] found that more than one-third of students had strained family relationships because of the COVID-19 pandemic, and most of these students found it harder to complete the semester at home. On the other hand, Davitt et al[39] found that college and university students living with a parent or guardian during the pandemic had less food insecurity, less need to work, lower stress, improved health status, and more home-cooked meals compared with students living on their own. Students who moved residences because of the pandemic, many back to their parents' homes, were also found to have a greater reduction in alcohol consumption than students who did not move.[40] Our data indicate that socialization with peers may be an additional factor to consider when assessing how living with family is associated with the mental health of college students.

Limitations

The findings reported in this study have limitations, including several associated with the study design. First, the nature and extent of the in-person component of the mixed course delivery models are unknown and could vary by school. For example, mixed course delivery models can refer to programs with some online and some in-person components or to programs that have a hybrid model in which some students attend online while others attend in person. On an individual level, mixed course delivery models may also vary. For instance, students who reported having mixed course delivery models may have had one class in person and the rest online, or they may have experienced all classes as hybrid. In addition, some students may have had a choice in the course delivery at any given time. Second, the study's cross-sectional design means that both the exposure and the outcomes were measured simultaneously, limiting causal inference. Third, the survey was administered online, and the measures were self-reported. Self-reported measures may be affected by recall bias and misinterpretation. Fourth, our study is limited by the available variables in the survey. For example, given the lack of data on socioeconomic status, food security was used as a proxy; however, it may not be an accurate measure of the socioeconomic status of college students. Similarly, while place of residence was included in our analysis, there may have been other factors about college students' living arrangements that were not considered. In addition, there may be other potentially significant factors associated with college students' well-being that we did not investigate. Future studies can examine how much of an in-person component is needed when a student engages in a mixed model to offset the mental health cost of online-only classes. In addition, it would be important to understand the extent to which these results hold under various pandemic conditions (ie, during a surge in cases) or under nonpandemic conditions.

Conclusions

Although the shift to online college classes has been shown to be feasible and arguably necessary in the context of the COVID-19 pandemic,[6,41] our study suggests a potential negative association between such a shift and college students' mental health. Our results have implications for educational institutions and policy makers weighing the risks and benefits when making determinations regarding school setting and transitions to online classes. Although online classes may be simpler logistically and may minimize the risk of COVID-19 transmission, they also may increase the risk of negative mental health sequelae that should not be ignored.

Our analysis also offers new insights regarding the association of widely scaled student educational experiences with individual psychological distress. A question that emerges is whether these same results would be maintained if online courses continued for a longer period of time (ie, would adaptations be made by students that would eventually mitigate psychological distress?) or if students had a choice in the way they take their courses. Finally, these results are particularly relevant to mental health professionals within educational settings. Knowing that a student is attending classes fully online may provide insight that informs therapeutic approaches and suggestions for recovery.

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SUPPLEMENT.
eAppendix. Covariates
eReferences.

Supplementary Online Content

ElTohamy A, Wang JJ, Chen JA, Stevens C, Liu CH. Association between college course delivery model and rates of psychological distress during the COVID-19 pandemic. *JAMA Netw Open.* 2022;5(11):e2244270. doi:10.1001/jamanetworkopen.2022.44270

eAppendix. Covariates
eReferences.

This supplementary material has been provided by the authors to give readers additional information about their work.

eAppendix. Covariates

Sociodemographic characteristics

Race/ethnicity, year in school, gender, and geographic region were included as covariates in the analysis. Race/ethnicity was included as a covariate in our analysis given the disparities in COVID-19-related psychosocial stressors between different race groups.[1,2] Race/ethnicity was coded as American Indian, Asian, Black, Hispanic, Middle Eastern, Multiracial, Native Hawaiian, White, or other based on the students' response to the question, "how do you usually describe yourself?" Choices included "American Indian or Native Alaskan," "Asian or Asian American," "Black or African American," "Hispanic or Latino/a/x," "Middle Eastern/North African (MENA) or Arab Origin," "Native Hawaiian or Other Pacific Islander Native," "White," "Biracial or Multiracial," and "My identity is not listed above." Students who reported more than one race were recoded and combined with those who reported "Biracial or Multiracial." Students who reported "my identity is not listed above" were recoded as other. Gender was coded as woman, man, or another gender identity based on students' self-report. Region was coded as Northeast, Midwest, South, or West based on the location of the student's institution. As a proxy for socioeconomic status in college students,[3–5] food security was measured using the 5-item USDA Food Security Short Scale Score with scores ranging from 0 to 6.[6,7] Questions asked about the last 30 days and included items like "I couldn't afford to eat balanced meals." Scores of 0-1 correspond to high or marginal food security, 2-4 correspond to low food security, and 5-6 correspond to very low food security. The Cronbach's α for these items in our sample was 0.86, indicating good reliability.

Current anxiety and/or depressive disorders

Participants who made up these groups reported receiving a diagnosis by a healthcare or mental health professional with either anxiety or depression, *and* had an appointment within the last 12 months to discuss their condition, *and* used medicine and/or therapy or other treatment for their condition. Note that among participants who reported receiving no treatment, they were still included in the respective group if they answered 'no' to "did a healthcare or mental health professional tell you that you do not need treatment, or that you can stop treatment, for [anxiety/depression]?" (a response of "no" to this item reflects individuals who prematurely stopped treatment against medical advice). Individuals without an appointment to discuss their condition within the last 12 months were not included as it was inferred that the condition may not be a present concern. The examples provided to the participants for anxiety disorders include generalized anxiety, social anxiety, panic disorder, and specific phobia. For depressive disorders, the provided examples include major depression, persistent depressive disorder, and disruptive mood disorder.

Socializing Time

Socializing time was measured using the question, "how many hours do you spend in a typical week … socializing with friends." Based on the distribution of responses, students who spent 0 hours socializing with friends were referred to as "low socializers." Individuals who spent 1-5 hours a week socializing with friends were referred to as "moderate socializers." Students who spent 6 or more hours a week socializing with friends were referred to as "high socializers."

COVID-19 concerns

Concerns about COVID-19 were measured using the question, "Over the past 30 days, on average, how much have you been concerned with the following?" The 6 items included in this

variable were, "How long the COVID-19 pandemic will last," "That you will get COVID-19 [or]

That you will get COVID-19 again," "That someone you care about will get COVID-19,"

"Someone you care about will die from COVID-19," "Not being able to spend time with people

you care about," and "Uncertainty of the future." Each item was measured on a 5-point Likert

scale ranging from "Not concerned at all" with a score of 0 to "Extremely concerned" with a

score of 4. The sum score ranged from 0 to 24. The Cronbach's α for these items in our sample

was 0.85, indicating good reliability.

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Summary of Conclusions

The COVID-19 pandemic has significantly impacted mental wellbeing of college students in the US. Although testing positive for COVID-19 is associated with lower odds of psychological distress, the increased financial hardship that college students faced during the pandemic is associated with almost double the odds of moderate-to-serious psychological distress. Losing a loved one to COVID-19 also significantly impacted college students' mental wellbeing.

The abrupt transition to online classes is another major challenge faced by most college students. Attending fully online classes is associated with modestly increased odds of moderate-to-serious psychological distress compared to attending mixed classes with an in-person component. Importantly, spending more time socializing with friends is significantly associated with lower odds of moderate-to-serious psychological distress.

Discussion and Perspectives

College students have faced significant stressors during the COVID-19 pandemic (2,7,9,17–19). Our aim was to understand the impact of these stressors on the mental well-being of college students. Both of our studies utilized a national sample of approximately 60,000 college students in the US during Spring 2021. Our first study (1) found that among three stressors, financial hardship had the most substantial effect on psychological distress. Interestingly, students who tested positive for COVID-19 reported lower psychological distress.

We also observed racial disparities in the distribution of COVID-19-related psychosocial stressors (testing positive for COVID-19, facing increased financial hardship, losing a loved one to COVID-19). Consistent with the high rates of COVID-19-related deaths in racial minorities compared to White individuals, students from every racial minority reported higher rates of losing loved ones than White students. Additionally, students from all racial minorities reported increased financial hardship relative to White students.

Our second study (2) identified an association between attending fully online classes and reporting slightly higher psychological distress. As expected, increased socializing time was associated with decreased psychological distress.

Both of our studies had limitations. First, the cross-sectional nature of the dataset does not allow for causal inference, nor does it allow for studying change over time. Second, the study relied on self-reported measures, which are subject to misinterpretation and recall bias. Lastly, while our study assessed a broad range of sociodemographic factors, it could not capture all variables, potentially leaving some factors unmeasured.

Major strengths of our two studies include the large sample size (about 60,000 students), the wide distribution and diversity of our sample, and the number of sociodemographic and psychosocial factors we controlled for. These strengths allowed us to relatively isolate the effects we investigated and report on the experiences of racial minority groups.

Our findings inform policymakers and decision-makers who may allocate more resources to support students under their purview. Future studies should further explore the impact of COVID-19-related psychosocial factors on college students' mental well-being. For example, longitudinal designs could enable causal inference. Additionally, mixed-methods studies may be necessary to better understand and map the various psychosocial stressors faced by college students. Future research could also focus on the specific mental health needs of international students, who may encounter unique challenges during the pandemic. Finally, employing advanced analyses using machine learning models may provide a more robust understanding of the interplay between the different factors affecting college students' mental well-being.

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