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Mental health in undergraduate students several months into the COVID-19 pandemic compared to before the pandemic

Eric J. Jacobs, PhD[a], **Sable Spiker, PhD**[b], **Kimberly B. Newsome, MPH**[a], **Melissa L. Danielson, MSPH**[a], **Sivapriya Bhupalam, MPH**[a,c], **Rebecca T. Leeb, PhD**[a]

[a]National Center on Birth Defects and Developmental Disabilities, Centers for Disease Control and Prevention, Atlanta, Georgia;

[b]Office of the Associate Director for Policy and Strategy, Centers for Disease Control and Prevention, Atlanta, Georgia;

[c]Oak Ridge Institute for Science and Education, Oak Ridge, Tennessee, USA

Abstract

Objective: To compare mental health indicators among undergraduates in Fall 2019, before the COVID-19 pandemic, and Fall 2020, when many students returned to campus amidst restrictions on in-person contact.

Participants: Analyses included 26,881 undergraduate students, aged 18–24, from 70 U.S. institutions.

Methods: Students completed the National College Health Assessment-III survey in Fall 2019 or Fall 2020.

Results: The prevalences of high stress, loneliness, a low flourishing score, and serious psychological distress increased in 2020 compared to 2019. Serious psychological distress increased substantially in 2020 among students not living with family (adjusted prevalence ratio (aPR)=1.36, 95% CI 1.29–1.45) but not among students living with family (aPR = 1.09, 95% CI 0.95–1.26).

Conclusions: These results suggest prevalences of several indicators of poor mental health were elevated among U.S. undergraduates several months into the pandemic. The pandemic may have had greater impact on mental health among students not living with family.

✉**CONTACT** Eric J. Jacobs, PhD ecj3@cdc.gov Centers for Disease Control and Prevention, National Center on Birth Defects and Developmental Disabilities, 4770 Buford Hwy NE, MS-S106-4 Atlanta, GA 30341-3717, USA.

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Conflict of interest disclosure

The authors have no conflicts of interest to report. The authors confirm that the research presented in this article met the ethical guidelines, including adherence to the legal requirements, of the United States. This analysis was determined by the United States Centers for Disease Control and Prevention not to be human subjects research requiring IRB approval.

Keywords

Anxiety; COVID-19; depression; mental health; university students

Introduction

On March 11, 2020, the World Health Organization declared COVID-19 a pandemic,[1] and many U.S. colleges and universities quickly closed their campuses in the middle of the school term.[2] A considerable number of studies of college and university students have compared indicators of mental health assessed during the first approximately six months of the pandemic (i.e. spring and summer of 2020) with the same indicators assessed before the pandemic.[3,4] In a meta-analysis of longitudinal studies of college or university students,[3] indicators of depression tended to be higher during the spring and summer of 2020 than before the pandemic, whereas indicators of anxiety did not show a consistent pattern.

More recently, studies have begun to explore the mental health impact of the pandemic on college and university students beyond the first six months of the pandemic (i.e. September 2020 or later). Such studies are needed because students faced different mental health challenges during the first six months than they did during later phases of the pandemic. For example, in the spring and summer of 2020, many students had to cope with being required to abruptly leave campus, whereas in the fall of 2020, many students returning to campus experienced significant long-term restrictions on in-person instructional and social activities.

Studies of undergraduate students from North America,[5–9] Europe,[10–15] Japan,[16] Brazil,[17] and South Africa,[18] have compared indicators of depression and/or anxiety assessed later in the pandemic (i.e. during or after September 2020) with the same indicators assessed before the pandemic. Most of these studies reported increases in indicators of depression,[5,7,8,10–15] although two found no change.[6,16] Results for indicators of anxiety have been less consistent, with some studies reporting an increase compared to before the pandemic[7–9,11,13] but other studies finding little change[6,15,16] or even a decrease.[14] Most of these studies of depression and/or anxiety were relatively small and included students from only one or two institutions. With the exception of the study from Brazil,[17] none of them included 1,000 or more students with mental health assessments from September 2020 or later. None of these studies examined the influence of mode of instruction or student residence on mental health during the pandemic.

We sought to better understand the influence of the COVID-19 pandemic on the mental health of undergraduate students during the fall of 2020, a time period when restrictions on in-person contact on college campuses may have been particularly stringent because many students had returned to campus, but wide-spread COVID-19 vaccination had not yet begun. Understanding the influence of the pandemic on undergraduate mental health during this time period will be important when balancing the risks and benefits of future long-term epidemic mitigation measures in undergraduate student populations. To assess the potential mental health impact of the pandemic in the fall of 2020, we compared the prevalence of indicators of mental health reported on the National College Health Association-III survey (NCHA-III) in the fall of 2020 to those reported on the same survey in the fall of 2019,

before the onset of the pandemic. Because we expected in-person contact in classes or with family might mitigate the impact of restrictions on other types of in-person contact, we also examined whether changes in the prevalence of indicators of mental health between the fall of 2020 and the fall of 2019 differed by mode of class instruction or whether a student was living with family.

Methods

Study population

We analyzed student responses to the National College Health Assessment-III (NCHA-III), an online survey developed and administered by the American College Health Association (ACHA) and described in detail elsewhere.[19] The NCHA-III codebook is available online.[20] Since the fall of 2019, the ACHA has administered the NCHA-III each fall and spring at participating colleges or universities. All students at participating colleges and universities were e-mailed invitations to complete the NCHA-III survey online. The NCHA-III data used in this analysis were provided in deidentified form by the ACHA. This analysis was determined by the Centers for Disease Control and Prevention not to be human subjects research requiring IRB approval.

This analysis includes students who completed the NCHA-III survey either in the fall of 2019 (before the pandemic) or the fall of 2020. We included all undergraduate NCHA-III survey respondents who (1) were enrolled full-time at a 4-year institution; (2) were aged 18–24 when they completed the survey; (3) provided information on at least one mental health measure; and (4) did not report requiring a visa to study or work in the United States. We did not include students who required a visa because many international students may have returned to their home countries in 2020 and experienced very different mental health challenges than students who remained in the U.S. We also did not include part-time students, students older than 24, or students at two-year institutions. We expected the influence of pandemic-related social restrictions on mental health would be different for these students than for full-time students 18–24, and there were too few respondents in these groups for separate analyses.

In total, this analysis included 26,881 undergraduate students: 20,232 students from 51 institutions who completed the Fall 2019 survey and 6,649 students from 20 institutions who completed the Fall 2020 survey. The smaller number of institutions participating in the NCHA-III survey in Fall 2020 was likely related to the pandemic. Specifically, institutions may participate in the NCHA-III survey on a periodical basis to monitor student health on their campus,[19] and may have been less interested in or had fewer resources available for assessing student health measures during an atypical year. Only one institution participated in both the Fall 2019 and Fall 2020 NCHA-III surveys and the data do not permit us to identify individual students from this institution who may have completed both surveys.

Response rates to the NCHA-III survey were not available specifically for the 18- to 24-year-old U.S. undergraduate subset studied in this analysis. However, overall response rates (i.e. including older undergraduate, graduate, and international students) for each participating institution were available from ACHA. To estimate the overall NCHA-III

survey response rates, we calculated the average response rate of participating institutions in each year, weighted by the proportion of participants in each year's sample from each institution. The weighted average response rate was 16% in 2019 and 15% in 2020.

Measures of mental health, residence, and mode of instruction

Measures of mental health, residence, and mode of instruction were derived from student responses to items on the NCHA-III survey as described below.

Stress level—Students were asked "Within the last 30 days, how would you rate the overall level of stress you have experienced?." Response options included "No stress," "Low," "Moderate," and "High."

Diagnosed mental disorders—Students were asked "Have you ever been diagnosed by a healthcare or mental health professional with any of the following ongoing or chronic conditions?" followed by a list of 40 physical and mental health conditions including: anxiety (e.g. generalized anxiety, social anxiety, panic disorder, and specific phobia); depression (e.g. major depression, persistent depressive disorder, and disruptive mood disorder); eating disorders (e.g. anorexia nervosa, bulimia nervosa, and binge-eating); obsessive-compulsive disorder and related conditions (e.g. obsessive-compulsive disorder, body dysmorphia, hoarding, trichotillomania, and other body-focused repetitive behavior disorders); and post-traumatic stress disorder (PTSD) (e.g. acute stress disorder, adjustment disorder, or another trauma- or stressor-related condition). The examples listed in parentheses above are those listed in the survey. Response options for each condition were "yes" and "no." If a participant reported "yes" for a condition, they were asked if they had had an appointment and/or discussion with a healthcare or mental health professional for that condition within the last 12 months (yes/no).

Disorder negatively impacted academic performance—Students were asked "Within the last 12 months, have any of the following affected your academic performance?" followed by a list of physical, mental, and experiential conditions. Mental conditions were: anxiety, depression, eating disorder/problem, PTSD, and stress. Only mental conditions were examined in this analysis. Response options for each condition were: "I did not experience this issue/not applicable," "I have experienced this issue, but my academics have not been affected," "I have experienced this issue and it negatively impacted my performance in class," and "I have experienced this issue and it delayed progress towards my degree." We categorized those who reported that the condition had "negatively impacted my performance in a class" or that it had "delayed progress towards my degree" as having had their academic performance negatively impacted.

In addition to the questions above, the NCHA-III survey included five established scales assessing mental and emotional health. Each of these scales is briefly described below.

Psychological distress—The Kessler K6 nonspecific distress scale is a 6-item psychological instrument designed to screen for serious mental illness.[21] Each item asks how often during the past 30 days the participant had felt a certain way (e.g. nervous, hopeless), and is scored from 0 (none of the time) to 4 (all of the time). Consistent with

previous studies,[22,23] we categorized total scores of 13 or higher as indicating "serious psychological distress."

Flourishing—The Diener Flourishing Scale is an 8-item scale of "self-perceived success in important areas such as relationships, self-esteem, purpose, and optimism."[24] Each item has possible scores from 1 (strongly disagree) to 7 (strongly agree). Total scores can range from 8 to 56, with higher scores indicating a more positive self-perception.

Resilience—The Connor-Davidson Resilience Scale 2 (CD-RISC2)[25] is a 2-item scale abbreviated from the original CD-RISC scale.[26] Total scores range from 0 to 8, with higher scores indicating greater resilience.

Loneliness—The Short UCLA Loneliness Scale (ULS3) is a 3-item scale that asks how often the respondent feels lonely in different ways, with each item scored from 1 (hardly ever) to 3 (often).[27] Total scores range from 3–9, with higher scores indicating higher loneliness. Consistent with previous studies,[28,29] we categorized scores of 6 or more as positive for loneliness.

Suicidality—The Suicide Behaviors Questionnaire-Revised (SBQ-R) is a 4-item questionnaire that asks about various aspects of suicidal ideation and behavior, with total scores ranging from 3 to 18.[30] We used the recommended general population cutoff score of 7 or more to indicate greater risk for suicidality.[30]

Residence—*S*tudents were asked "Where do you currently live" and could choose one of the following: "campus or university housing," "parent/guardian/other family member's home," "off-campus or other non-university housing," "temporarily staying with a relative, friend, or 'couch surfing' until I find housing," "I don't currently have a place to live," or "other." In analyses by residence, we counted "parent/guardian/other family member's home" as living with family, "off-campus or other non-university housing" and "campus" as not living with family, and excluded participants with other responses (89 from 2019 and 50 from 2020).

Mode of instruction—*S*tudents responded to the prompt "I am taking classes this term" with one of the following options: "entirely in-person," "entirely online," or "a mix of in-person and online classes." This question was asked only in Fall 2020.

Statistical analyses

We calculated the prevalence of each mental health indicator in the fall of 2019 and the fall of 2020 standardized to the covariate distribution of the combined 2019/2020 NCHA-III population included in this analysis using model-based standardization[31] on year of undergraduate study, gender, race/ethnicity, parent education level, attention deficit hyperactivity disorder (ADHD), learning disability, other disability, and institution region, size, and category. In other words, we used a logistic regression model to calculate what the prevalence of each mental health indicator would have been among Fall 2019 students or Fall 2020 students if each of these student groups had had the same distribution of each of the covariates listed above as the combined population of Fall 2019 and Fall 2020

students. This process adjusted prevalence estimates for differences in covariates between the Fall 2019 and Fall 2020 student groups so that prevalence estimates from 2019 and 2020 could be more validly compared. We then calculated adjusted prevalence ratios (aPR's) comparing the prevalence of each mental health indicator in the fall of 2020 to that in the fall of 2019 using Poisson regression models[32] adjusted for the covariates above. Adjusted prevalence ratios presented in this analysis are the estimated ratio of the prevalence of a mental health indicator in the fall of 2020 to the prevalence of the same indicator in the fall of 2019, accounting for differences in the distribution of covariates between Fall 2019 and Fall 2020 participants. For example, an adjusted prevalence ratio of 1.25 indicates the estimated adjusted prevalence was 25% higher in Fall 2020 participants than in Fall 2019 participants. Adjusted prevalence ratios with 95% confidence intervals that do not include 1.0 have a corresponding P-value of < 0.05.

We hypothesized that the effect of the COVID-19 pandemic on student mental health might differ by mode of educational instruction (online only vs. a mix of in-person/online instruction). However, mode of instruction was assessed only in the fall of 2020. We therefore calculated prevalence ratios comparing students with only online instruction in 2020 to all students in 2019, and then calculated separate prevalence ratios comparing students with mixed instruction in 2020 to the same referent group of all students in 2019.

We examined prevalence ratios for mental health indicators within subgroups defined by living situation (with or away from family) and by various demographic factors (year of undergraduate study, race/ethnicity, gender, and disability status). P-values for differences in prevalence ratios between subgroups were calculated by modeling a multiplicative interaction term (or terms) between a dichotomous variable for study year (2020 vs. 2019) and a variable (or variables) for each potentially modifying factor.

Finally, we conducted a sub-analysis restricted to students from the one institution whose students participated in both the Fall 2019 and Fall 2020 surveys. This sub-analysis was intended to determine if the results observed in the full analysis, which compares students from a mix of institutions, were consistent with those observed within a single institution.

Results

Students who completed the NCHA-III survey in the fall of 2020 were generally demographically similar to students who completed the survey a year earlier in the fall of 2019 (Table 1). All students in both survey years were 18–24 years old at the time of survey completion because students younger than 18 were not allowed to complete the survey and students older than 24 were excluded from this analysis. Most students in both survey years were between 18 and 21 (90% in 2019 and 87% in 2020). In addition, most students in both survey years were women and non-Hispanic White, although the proportion who were women and the proportion who were non-Hispanic White were slightly higher in 2020 than in 2019.

Regarding education-related characteristics, a lower proportion of students lived on campus in 2020 than in 2019 (39% vs. 58%) and a higher proportion lived with a parent/guardian or

other family member (29% vs. 14%) (Table 1). Students in 2019 and 2020 were generally similar with respect to the size and classification of the institutions they were enrolled in, although a higher proportion of 2020 students were enrolled in the Northeast and a lower proportion in the Midwest. Among 2020 students, most reported only online instruction (38%) or a mix of online and in-person instruction (60%).

The prevalences of multiple indicators of poorer mental health were higher in 2020 than in 2019 (Table 2). aPR's comparing prevalences in 2020 to those in 2019 had confidence intervals that excluded one for high stress, having seen a professional in the last 12 months for anxiety, a negative impact of anxiety, depression, eating disorders, or stress on academic performance, loneliness, suicidality, serious psychological distress, and a low score on the flourishing scale. Notably, there were sizable increases in 2020 in the prevalence of a low score on the flourishing scale (up 54%) and the prevalence of serious psychological distress (up 32%).

Unadjusted PR's and PR's adjusted only for age and gender are shown in Supplemental Table S1, available online. Some unadjusted PR's were higher than the corresponding multivariable-adjusted PR's. However, PR's adjusted only for gender and region were similar to multivariable-adjusted PR's.

There were few notable differences in results between subgroups defined by gender, race/ethnicity, year of study, and disability status (Tables S2–S5, available online). Whereas the prevalence of having been seen by a professional for depression or anxiety was higher in 2020 than in 2019 among students without ADHD and among students without "other disabilities," there was no apparent change across time periods in prevalence among students with these conditions (Table S5, available online). In addition, while the prevalence of a low score on the flourishing scale increased in 2020 among both students with and without ADHD, and among both students with and without other disabilities, aPR's comparing 2020 to 2019 were smaller among students with ADHD and students with "other disabilities." While the prevalence of a low-resilience score did not change overall from 2019 to 2020, there was an unexpected decrease in prevalence specifically among Non-Hispanic Black students (aPR = 0.68, 95% CI 0.49–0.94) in Fall 2020 (Table S3, available online). Results of a subanalysis within the one institution that participated in both the Fall 2019 and Fall 2020 surveys were similar to those in the overall analysis (Table S6, available online).

aPR's are shown separately by residence and mode of class instruction in Table 3. In analyses by residence, the aPR for serious psychological distress was higher among students living away from family (aPR = 1.36, 95% CI 1.29–1.45) than among students living with family (aPR = 1.09, 95% CI 0.95–1.26) (p = 0.005 for interaction by residence) (Table 3). Similarly, aPR's for loneliness and high stress were higher among students living away from family than among students living with family (P-values for interaction by residence = 0.02 for loneliness and 0.03 for high stress, respectively).

Figure 1 shows the prevalence of serious psychological distress by year and residence. While the prevalence of serious psychological distress was higher in 2020 than 2019 regardless

of family residence category, the difference between 2020 and 2019 was greater among students who were not living with family.

For several mental health indicators, the aPR's comparing online-only 2020 students to 2019 students were higher than the corresponding aPR's comparing mixed instruction 2020 students to 2019 students (Table 3). These indicators were a low flourishing scale score, having seen a health professional for anxiety or depression in the last 12 months, and reporting that anxiety or depression had a negative impact on academic performance ($p < 0.05$ for heterogeneity in aPR's).

Figure 2 shows the prevalence of a low flourishing scale score in three groups of students (all 2019 students, 2020 students with mixed instruction, and 2020 students with only online instruction) to illustrate the higher prevalence of a low flourishing scale score in 2020 students with only online instruction.

Discussion

In this large multi-institutional survey of U.S. undergraduate students, the prevalences of multiple indicators of poor mental health were higher several months after the onset of the pandemic than they were before the pandemic. For several indicators of poor mental health, the size of the increase in prevalence between 2019 and 2020 differed by student living situation. Notably, the increase in the prevalence of serious psychological distress in 2020 was substantially smaller among students living with family.

One of the largest increases in prevalence we observed was the estimated 32% increase in the prevalence of serious psychological distress in our undergraduate study population in 2020 compared to 2019. To our knowledge, no previous study of undergraduate students has compared the Kessler-6 score or a similar broad measure of mental illness assessed in September 2020 or later with the same measure assessed before the pandemic. A recent cross-sectional analysis of students who completed the NCHA-III in the spring of 2021 reported a slightly higher adjusted mean Kessler-6 score among students receiving online-only instruction than among those receiving some in-person instruction.[33] We did not observe a difference in the prevalence of serious psychological distress by mode of instruction in the fall of 2020, but mean Kessler-6 score and prevalence of serious psychological distress are not necessarily comparable measures.

We also observed increases between the fall of 2019 and the fall of 2020 in the prevalence of having had academic performance negatively impacted by anxiety or depression and of having been seen by a professional in the last 12 months for anxiety or depression. However, the estimated magnitude of the increases in the prevalence of these four outcomes was relatively small (ranging from 6% to 14%). The small increases in anxiety-related responses observed in our study in 2020 are consistent with the mixed results about anxiety observed in previous studies of undergraduate populations with assessments at least six months after the start of the pandemic (described in the introduction). The increase in the prevalence of indicators related to depression in our study was smaller than we expected. Most,[5,7,8,10–15] though not all,[6,16] studies of undergraduates with assessments at least six months after

the start of the pandemic have observed sizable increases in indicators of depression. However, the wording of the NCHA-III questions needs to be considered. Not all students experiencing anxiety or depression will report that these conditions impacted their academic performance. In addition, the prevalence of having been seen by a professional for anxiety or depression may underestimate true increases in the prevalence of these conditions as many students with anxiety or depression may not have been seen by a mental health professional. In a survey in late January 2021, 23% of adults aged 18–29 reported that they had needed, but not received, counseling or therapy in the last four weeks, a substantially higher percentage than in adults over age 30.[34]

Notably, the increased prevalence of having been seen by a professional for anxiety or depression in Fall 2020 (compared to Fall 2019) was not observed among either students with ADHD or among students categorized as having another disability. In addition, while the prevalence of a low-flourishing score increased in Fall 2020 among both students with and without disabilities, this increase was less marked among students with ADHD or other disabilities than among other students. What explains this pattern of results is unclear. For some students with disabilities, living away from home in a campus environment requiring frequent social interaction may increase anxiety and depression. Therefore, mitigation measures used in Fall 2020, such as remote study or limiting social interaction on campus, may actually have reduced anxiety or depression in some students with disabilities.

We observed a modest increase in the prevalence of eating disorders in the fall of 2020 compared to the fall of 2019. Previous literature on eating disorders in young adults during the pandemic is limited. In an analysis of emergency department visits in the U.S.,[35] visits for eating disorders among people aged 18–24 were elevated during February and March of 2021, shortly after a peak in COVID-19 cases.

We also observed relatively small increases between 2019 and 2020 in the prevalence of loneliness, suicidality, and high stress. Only a few studies have investigated potential increases in these conditions among undergraduates six or more months after the start of the pandemic. These studies were relatively small and may have had limited statistical power to detect small effects, making it difficult to compare their results with ours. The only such study to examine loneliness found a higher prevalence during the pandemic,[12] while two[10,17] of three[10,14,17] studies found a higher prevalence of suicidality, and one[36] of two[6,36] studies found a higher prevalence of high stress.

In our study, increases in the prevalence of some mental health indicators between 2019 and 2020, including serious psychological distress, high stress in the last 30 days, and loneliness, were smaller among students living with their family than among students living away from family. This difference in results by family residence is plausible. Mitigation measures to limit the spread of the virus implemented in 2020, such as social distancing on campus, may have caused social isolation and thereby contributed to poorer mental health. These mitigation measures may have been less likely to cause social isolation among students living with family and therefore have had less impact on psychological distress, stress, and loneliness. Our results are consistent with those from a study of Chinese undergraduate medical students during the early weeks of the pandemic that found an inverse association

between living with family and moderate or severe anxiety.[37] Our results are also consistent with those from a small study of French college students during a two-month mandatory confinement period at the start of the pandemic in March 2020.[38] In that study, students who relocated immediately before the start of the confinement period, usually to live with one or both parents, were less likely to report high stress or increased anxiety than those who did not. However, these results are difficult to interpret given that many students who did not relocate were already living with a parent.

Our finding that the pandemic may have had a smaller impact on mental health among students living with family could have practical implications when stringent restrictions on social contact on campus must be implemented to protect public health. Specifically, the adverse mental health impact of social restrictions might be reduced by encouraging some students to consider relocating to live with family. However, it is important to recognize that each student's family and financial situation is different; relocating to live with family will not always be a viable option.

The prevalence of a low score on the Diener flourishing scale[24] increased substantially between the fall of 2019 and the fall of 2020. This result is similar to those of two other studies that compared measures from before the pandemic with those assessed at least six months after the start of the pandemic, a study from a South African university[18] that also used the Diener flourishing scale, and a study from an English university[36] that used a similar measure of well-being.[39]

The prevalence of a low score on the Diener flourishing scale increased in 2020, compared to 2019, for students with mixed in-person instruction in 2020 (aPR = 1.44), but increased even more for students with only online instruction in 2020 (aPR = 1.72). The Diener flourishing scale includes questions about self-perceived success in relationships and engagement in daily activities,[24] and would therefore be expected to be adversely affected by social isolation. It is possible that students with only online instruction in 2020 may have experienced greater social isolation, resulting in lower scores on the Diener flourishing scale.

This study has several important strengths. First, we were able to compare measures of mental health ascertained before the pandemic in the fall of 2019 with the same measures ascertained after resumption of studies in the fall of 2020, both overall and within subgroups defined by student residence and other student characteristics. To our knowledge, this multi-institutional study is by far the largest such study of undergraduate students to date. Second, the NCHA-III survey included a broad range of mental health measures, including five established scales and several additional questions concerning mental health. Finally, the NCHA-III survey included mode of instruction and residence, enabling us to examine whether the influence of the pandemic on mental health might have differed by these potentially modifiable factors.

This study also has several notable limitations. First, we interpreted increases in the prevalence of poorer mental health in the fall of 2020 as largely attributable to the COVID-19 pandemic and the measures taken to mitigate it. However, factors unrelated

to the pandemic could also have contributed to poorer mental health in the fall of 2020. Second, we did not have specific information on the mitigation policies each student experienced; some students undoubtedly experienced more stringent mitigation policies than others. Future research studies are needed to clarify the impact of specific mitigation policies experienced by individual students on a broad range of mental health measures. Third, some prospective students may have chosen not to enroll in college or return to school in 2020 because of the pandemic. If a high proportion of these prospective students had mental health problems, their absence could have reduced the prevalence of mental health problems among NCHA-III respondents in 2020. Fourth, the NCHA-III is not designed to produce a representative sample of all college students in the United States; participating institutions are self-selected, and response rates are low. The absolute prevalences of mental health measures observed in this NCHA-III data should therefore not be generalized to all U.S. college students. However, response rates to NCHA-III were similar in 2019 and 2020, so changes between 2019 and 2020 may therefore be informative about changes among full-time U.S. undergraduates. Finally, this study was not a longitudinal study of the same participants, but rather a repeated cross-sectional analysis including different participants at the two survey timepoints. Most previous studies of undergraduates with mental health measures from both before the pandemic and from September 2020 or later are also cross-sectional analyses, although there have been three longitudinal studies from Europe.[13,14,36] Due to our repeated cross-sectional design, we may have overestimated or underestimated changes in prevalence if the association between study participation and mental health status changed substantially between the fall of 2019 and the fall of 2020.

In summary, our results, consistent with those from smaller studies, provide evidence that the pandemic may have contributed to a higher prevalence of a wide range of indicators of poor mental health in U.S. college students during the fall of 2020, when many campuses reopened with significant restrictions on in-person contact. Our results suggest that future epidemic mitigation efforts that require significant restrictions on in-person contact could increase demands on mental health practitioners serving college students. Vaccination against COVID-19 became widely available in the U.S. in 2021, and many restrictions on in-person contact on campus present in the fall of 2020 may since have been relaxed. However, the public health and education communities will likely be confronted with new epidemics in the future. Our results, together with those from other studies, provide information on potential mental health impacts that will merit consideration when balancing the risks and benefits of long-term epidemic mitigation measures in full-time undergraduate student populations.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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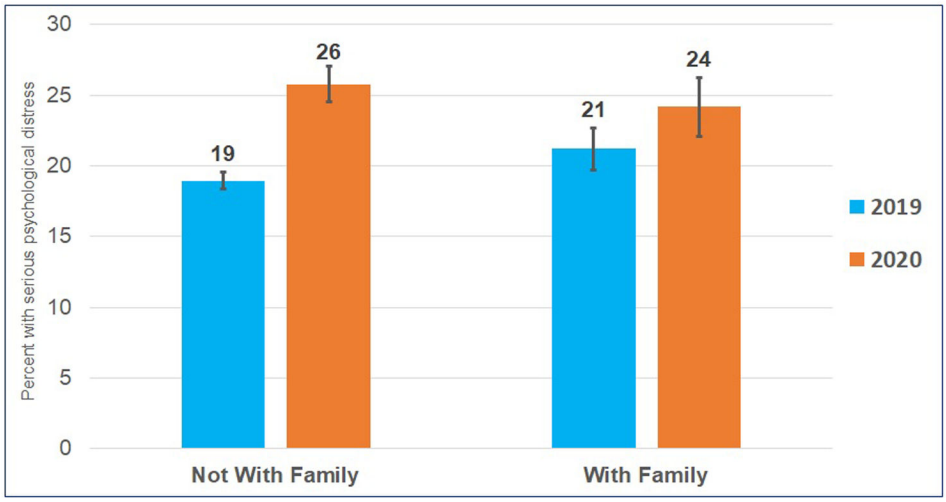

Figure 1.

Note: Figure shows the prevalence of serious psychological distress, based on the Kessler-6 scale, among full-time U.S. undergraduate respondents to the National College Health Assessment-III Fall 2019 and Fall 2020 surveys. Results shown separately by residence with or away from family. Error bars indicate 95% confidence intervals.

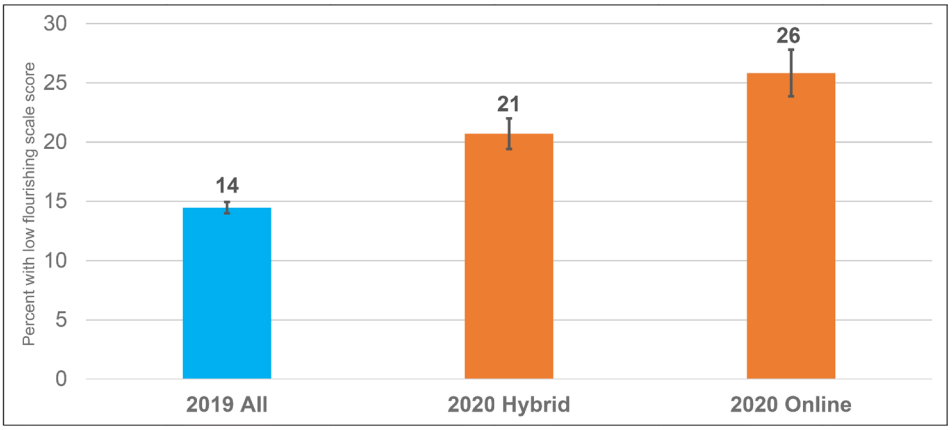

Figure 2.

Note: Figure shows the prevalence of a score of less than 40 on the Diener flourishing scale among full-time U.S. undergraduate respondents to the National College Health Assessment-III Fall 2019 and Fall 2020 surveys. Results from Fall 2020 respondents are shown stratified by mode of instruction, either entirely online, or a mix of online and in-person (hybrid). Error bars indicate 95% confidence intervals.

Table 1.

Characteristics of U.S. undergraduate students before and during the COVID-19 pandemic, National College Health Assessment-III.

	Fall 2019 (before COVID-19)		Fall 2020 (during COVID-19)	
	N = 20,232[a]		*N* = 6,649[a]	
	N	%	N	%
Age (years)				
18–19	10,094	49.9	3,041	45.7
20–21	8,056	39.8	2,778	41.8
22–24	2,082	10.3	830	12.5
Gender				
Cisgender woman	12,922	63.9	4,686	70.5
Cisgender man	6,720	33.2	1,703	25.6
Transgender/gender nonconforming	590	2.9	260	3.9
Race and ethnicity				
Non-Hispanic White	12,560	62.1	4,596	69.1
Non-Hispanic Black	1,836	9.1	393	5.9
Hispanic	2,015	10.0	395	5.9
Asian/Hawaiian/Pacific Islander	1,345	6.6	444	6.7
Other/unknown/Multiracial	2,476	12.2	821	12.3
Attention deficit hyperactivity disorder (ADHD)	1,765	8.7	763	11.5
Learning disability	669	3.3	273	4.1
Other disability	805	4.0	297	4.5
Highest level of parent education				
Less than high school	525	2.6	176	2.6
High school/GED	2,804	13.9	918	13.8
Some college	1,763	8.7	633	9.5
Associate’s degree or trade/technical school	1,706	8.4	608	9.1
Bachelor’s degree	5,937	29.3	2,011	30.2
Master’s degree	5,017	24.8	1,524	22.9
Doctoral/professional degree	2,306	11.4	709	10.7
Don’t know	174	0.9	70	1.1

	Fall 2019 (before COVID-19)		Fall 2020 (during COVID-19)	
	N = 20,232[a]		*N* = 6,649[a]	
	N	%	N	%
Year of undergraduate study				
1st	6,177	30.5	1,808	27.2
2nd	4,663	23.0	1,569	23.6
3rd	4,535	22.4	1,605	24.1
4th	4,141	20.5	1,342	20.2
5th or more	716	3.5	325	4.9
Current residence				
Campus/university	11,812	58.4	2,622	39.4
Parent/guardian/other family	2,848	14.1	1,893	28.5
Off-campus/non-university	5,483	27.1	2,084	31.3
Temporary/none/other	89	0.4	50	0.8
Mode of class instruction[b]				
Entirely online	—	—	2,522	38.0
Mix of in-person/online	—	—	4,002	60.2
Entirely in-person	—	—	124	1.9
Institution census region				
Northeast	4,883	24.1	2,598	39.1
Midwest	5,467	27.0	929	14.0
South	8,421	41.6	2,685	40.4
West	1,461	7.2	437	6.6
Institution size (number of students)				
< 2,500	2,500	12.4	924	13.9
2,500–4,999	2,515	12.4	257	3.9
5,000–9,999	4,980	24.6	1,275	19.2
10,000–19,999	4,032	19.9	1,917	28.8
≥ 20,000	6,205	30.7	2,276	34.2
Institution category				
Baccalaureate college	2,851	14.1	1,249	18.8
Master’s colleges or university	3,763	18.6	1,094	16.5

	Fall 2019 (before COVID-19)		Fall 2020 (during COVID-19)	
	N = 20,232[a]		*N* = 6,649[a]	
	N	%	N	%
Doctoral university	13,079	64.6	3,655	55.0
Special focus institution	539	2.7	651	9.8

[a] Counts for some variables do not sum to this number due to missing data.

[b] Mode of instruction was included only on the fall 2020 NCHA-III survey.

Table 2.

Prevalence and prevalence ratios of mental health indicators before compared to during the COVID-19 pandemic, National College Health Association Survey-III.

	Fall 2019 (before COVID-19) *N* = 20,232[a]		Fall 2020 (during COVID-19) *N* = 6,649[a]		Multivariable-adjusted prevalence ratio (during vs. before COVID-19)
	N	% (95% CI)	N	% (95% CI)	aPR (95% CI)[b]
Mental health indicator					
Stress level in last 30 days					
None	291	1.4 (1.3–1.6)	75	1.1 (0.9–1.4)	0.89 (0.68–1.16)
Low	4,333	21.5 (20.8–22.1)	1,056	15.9 (15.0–16.9)	0.80 (0.75–0.86)
Moderate	9,937	49.2 (48.2–50.2)	3,281	49.4 (47.7–51.1)	1.00 (0.97–1.03)
High	5,635	27.9 (27.2–28.6)	2,233	33.6 (32.2–35.0)	1.14 (1.10–1.19)
Seen by professional in last 12 months for[c,d]					
Anxiety	3,573	17.7 (17.1–18.3)	1,491	22.5 (21.4–23.7)	1.11 (1.05–1.17)
Depression	2,827	14.0 (13.5–14.5)	1,094	16.5 (15.6–17.5)	1.06 (0.99–1.13)
Eating disorder	368	1.8 (1.6–2.0)	163	2.5 (2.1–2.9)	1.03 (0.84–1.25)
Posttraumatic stress disorder	519	2.6 (2.4–2.8)	229	3.5 (3.0–3.9)	1.14 (0.97–1.34)
Obsessive compulsive disorder	526	2.6 (2.4–2.8)	234	3.5 (3.1–4.0)	1.06 (0.90–1.25)
Academic performance negatively impacted by					
Anxiety	5,952	29.7 (28.9–30.4)	2,403	36.4 (35.0–37.9)	1.14 (1.09–1.18)
Depression	4,601	22.8 (22.2–23.5)	1,779	26.8 (25.6–28.1)	1.10 (1.04–1.15)
Eating disorder	573	2.9 (2.6–3.1)	265	4.0 (3.5–4.5)	1.21 (1.03–1.42)
Posttraumatic stress disorder	505	2.5 (2.3–2.7)	216	3.3 (2.8–3.7)	1.11 (0.93–1.31)
Stress	8,281	41.1 (40.3–42.0)	3,103	46.8 (45.2–48.4)	1.08 (1.05–1.12)
Positive for loneliness[e]	10,149	50.2 (49.3–51.2)	3,610	54.5 (52.8–56.4)	1.08 (1.05–1.11)
Positive for suicidality[f]	5,044	25.0 (24.3–25.7)	1,805	27.3 (26.1–28.6)	1.07 (1.02–1.12)
Psychological distress (Kessler-6 scale)					
0–6	7,695	38.5 (37.7–39.4)	1,948	29.5 (28.2–20.8)	0.79 (0.76–0.83)
7–12	8,450	42.3 (41.4–43.2)	2,930	44.4 (42.8–46.0)	1.04 (1.01–1.08)
≥ 13 (serious psychological distress)	3,819	19.1 (18.5–19.7)	1,725	26.1 (24.9–27.4)	1.32 (1.25–1.39)
Resilience (connor-Davidson Resilience Scale-2)					

	Fall 2019 (before COVID-19) *N* = 20,232[a]		Fall 2020 (during COVID-19) *N* = 6,649[a]		Multivariable-adjusted prevalence ratio (during vs. before COVID-19)
	N	% (95% CI)	N	% (95% CI)	aPR (95% CI)[b]
0–4 (low resilience)	3,264	16.2 (15.6–16.7)	1,115	16.9 (15.9–17.9)	1.02 (0.96–1.09)
5–6	9,806	48.6 (47.7–49.6)	3,429	51.9 (50.2–53.7)	1.06 (1.03–1.09)
7–8	7,101	35.2 (34.4–36.0)	2,063	31.2 (29.9–32.6)	0.91 (0.87–0.95)
Flourishing (Diener scale score)					
8–39 (low flourishing)	2,927	14.5 (14.0–15.1)	1,463	22.1 (21.0–23.3)	1.54 (1.45–1.63)
40–44	2,726	13.5 (13.0–14.1)	1,135	17.2 (16.2–18.2)	1.27 (1.19–1.36)
45–49	6,630	32.9 (32.2–33.7)	2,149	32.5 (31.2–33.9)	0.99 (0.95–1.04)
50–56	7,848	39.0 (38.1–39.9)	1,862	28.2 (26.9–29.5)	0.72 (0.68–0.75)

[a] Counts for specific variables may not sum to this number due to missing data.

[b] aPR is the ratio of the prevalence in Fall 2020 to that in Fall 2019 adjusted for undergraduate year, gender, race/ethnicity, parent education, ADHD status, learning disability status, other disability status, and institution region, size, and type.

[c] Ascertained only among those who reported ever having been diagnosed with this condition, others categorized as no.

[d] Categories are not mutually exclusive.

[e] UCLA Three-Item Loneliness Scale score ≥ 6.

[f] Suicide Behavior Questionnaire-Revised score ≥ 7.

Table 3.

Prevalence ratios for mental health indicators before compared to during the COVID-19 pandemic, by residence and mode of instruction, National College Health Association Survey-III.[a]

	Current residence			Mode of class instruction in Fall 2020		
	With family	Not with family	*P* value[b]	Mixed on-line and in-person	On-line only	*P* value[c]
Mental health measure						
High stress level in last 30 days[d]	1.07 (0.95–1.20)	1.16 (1.10–1.21)	0.03	1.15 (1.10–1.21)	1.10 (1.03–1.18)	0.49
Seen by professional in last 12 months for						
Anxiety	1.23 (1.04–1.45)	1.10 (1.03–1.17)	0.33	1.05 (0.98–1.13)	1.26 (1.16–1.38)	< 0.001
Depression	1.12 (0.92–1.37)	1.06 (0.98–1.14)	0.94	1.06 (0.99–1.12)	1.24 (1.15–1.34)	< 0.001
Academic performance negatively impacted by						
Anxiety	1.12 (1.00–1.26)	1.15 (1.10–1.20)	0.28	1.11 (1.06–1.17)	1.20 (1.13–1.28)	0.02
Depression	1.12 (0.97–1.29)	1.11 (1.05–1.17)	0.74	1.01 (0.93–1.09)	1.24 (1.12–1.38)	< 0.001
Stress	1.11 (1.02–1.22)	1.09 (1.05–1.13)	0.40	1.08 (1.04–1.12)	1.12 (1.06–1.18)	0.28
Positive for loneliness[e]	1.03 (0.96–1.11)	1.09 (1.06–1.13)	0.02	1.09 (1.05–1.12)	1.06 (1.01–1.11)	0.35
Positive for suicidality[f]	0.94 (0.82–1.08)	1.08 (1.02–1.14)	0.23	1.06 (1.00–1.13)	1.12 (1.04–1.21)	0.28
Serious psychological distress[g]	1.09 (0.95–1.26)	1.36 (1.29–1.45)	0.005	1.30 (1.22–1.39)	1.35 (1.24–1.47)	0.31
Low resilience[h]	0.93 (0.79–1.10)	1.03 (0.95–1.11)	0.12	1.01 (0.93–1.09)	0.99 (0.89–1.10)	0.87
Low flourishing[i]	1.33 (1.14–1.55)	1.54 (1.43–1.65)	0.27	1.44 (1.34–1.54)	1.72 (1.57–1.89)	0.001

[a] Ratio of prevalence in Fall 2020 to that in Fall 2019, adjusted for undergraduate year, gender, race/ethnicity, parent education, ADHD, learning disability, other disability, and institution region, size, and type.

[b] *P* value for difference in prevalence ratios between “with family” and “not with family” categories.

[c] *P* value for difference in prevalence ratios between mode of instruction categories, excluding a small number of participants with in-person only classes.

[d] Selected response category of “high” on NCHA-III question on stress level.

[e] Short UCLA Loneliness Scale ≥ 6.

[f] Suicide Behavior Questionnaire-Revised score ≥ 7.

[g] Kessler-6 scale ≥ 13.

[h] Connor-Davidson Resilience Scale-2 score ≤ 4.

[i] Diener scale score < 40.