

Original Paper

College Students' Well-being during the COVID-19 Pandemic:

A Systematic Review of the Literature

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Abstract

Studies have shown increased levels of distress during the coronavirus disease-19 (COVID-19) pandemic, and college students are becoming more recognized as a vulnerable population. This narrative systematic review aims to synthesize the current understanding of mental health, lifestyle, and socioeconomic impacts that the pandemic had on college students in the United States. A search was conducted on PubMed, PsycInfo, and Web of Science. A total of 34 observational studies were included which examined aspects of college students' health and experiences during the COVID-19 pandemic in the United States. A great deal of students was shown to experience a moderate level of stress and subsyndromal depression and anxiety in the early months of the COVID-19 pandemic. Several risk and protective factors have been characterized. Students experienced various academic, financial, and housing disruptions. Studies have highlighted the need for institutional support to reduce the adverse psychological impact of the pandemic. There is a need for further large-scale research to assess the scope of COVID-19-related biopsychosocial impact, especially in vulnerable populations such as racial/ethnic and sexual/gender minorities.

Keywords

mental health, COVID-19, college students, psychological, depression, anxiety

1. Introduction

The coronavirus disease-2019 (COVID-19) pandemic abruptly changed people's daily routines and continues to affect how people live across the globe. Self-care includes various behaviors, such as healthy eating, exercise, relaxation, social connection, spirituality. Many of these aspects have been affected by restrictions and changes instated during the COVID-19 pandemic that may have prevented people from practicing their usual health-related behaviors or added a substantial amount of uncertainty.

Several studies have been conducted across the globe to study mental health in young adults (18-29 years old) and college students. The current understanding is that young adults are suffering from relatively high rates of perceived stress and that symptoms of depression and anxiety are common psychological reactions to the pandemic (Rajkumar, 2020; Xiong et al., 2020). At baseline, the college student population is particularly vulnerable to stress due to concerns related to academic performance, finances, interpersonal relationships, and post-graduation plans (Beiter et al., 2015). Psychosocial challenges are therefore compounded when faced with public health emergencies.

There is a growing volume of literature available on this topic. It is important to evaluate the current evidence and determine trends in results to inform future research and interventions. The purpose of the study is to identify manifestations of psychological distress among college students, common coping behaviors, and challenges to managing self-care. The current review was designed to summarize the existing literature addressing health concerns among college students during the COVID-19 pandemic. Limitations to the existing literature should be addressed in future research. To our knowledge, this is the first review of the literature on this topic in this population to date.

2. Method

This article is a narrative review of the existing literature on mental health symptoms and behaviors during the COVID-19 pandemic.

2.1 Information Sources & Eligibility Criteria

Three online databases (PubMed, American Psychological Association PsychInfo, and Web of Sciences) were searched for relevant articles. Studies were included if they were observational in nature (cross-sectional, cohort, ecological), examined college students older than 18 years of age in the United States, and available in English language. They had to include information on aspects of well-being, such as stress, anxiety, depression, or health-related behaviors.

2.2 Search Methodology

A literature search was conducted with the search terms: "college students" or "university students" and "mental health" or "health" or "stress" or "depression" and "pandemic" or "covid-19" or "coronavirus". The search was filtered such that only results available in English from 2020 to 2021 were included. If possible, a location filter for the United States was applied.

2.3 Study Selection & Data Collection

After initial review, studies were screened by title and abstract to determine potential relevance. The full-text articles determined to be relevant were assessed for inclusion in the review. Data were taken directly from articles. No contact was made with authors of the publications to obtain raw data or confirm results.

3. Result

Well-being is multifactorial and can be approached from various disciplines. Therefore, there is a wide variety of study designs, analytical processes, and assessed outcomes. It is important to summarize this information from the breadth of sources available. Due to the heterogeneity of study designs, including assessment scales used, it was decided not to conduct a formal meta-analysis at this time. A narrative review was conducted to analyze the various methods used, categorize salient themes, and summarize the current literature.

3.1 Study Selection

Results from study selection are shown in the study flow diagram in Figure 1. On the initial search, 134 studies were identified. Duplicates (n=32) were removed. Titles and abstracts of 101 articles were screened to confirm the location of study. International studies and studies taking place outside the United States were excluded, resulting in exclusion of 40 articles. Full-text articles were then retrieved and assessed for eligibility. Only original research papers were included; letters to the editor (n=3), editorials or commentary related to mental health (n=11), and reviews (n=3) were excluded. 12 articles were also excluded based on sample characteristics (n=4; e.g., sample not limited to college students) and subject matter (n=8; e.g., therapeutic interventions). The remaining 34 publications are included in this review. Characteristics of each study, including design, location, sample, and findings are shown in Appendix A.

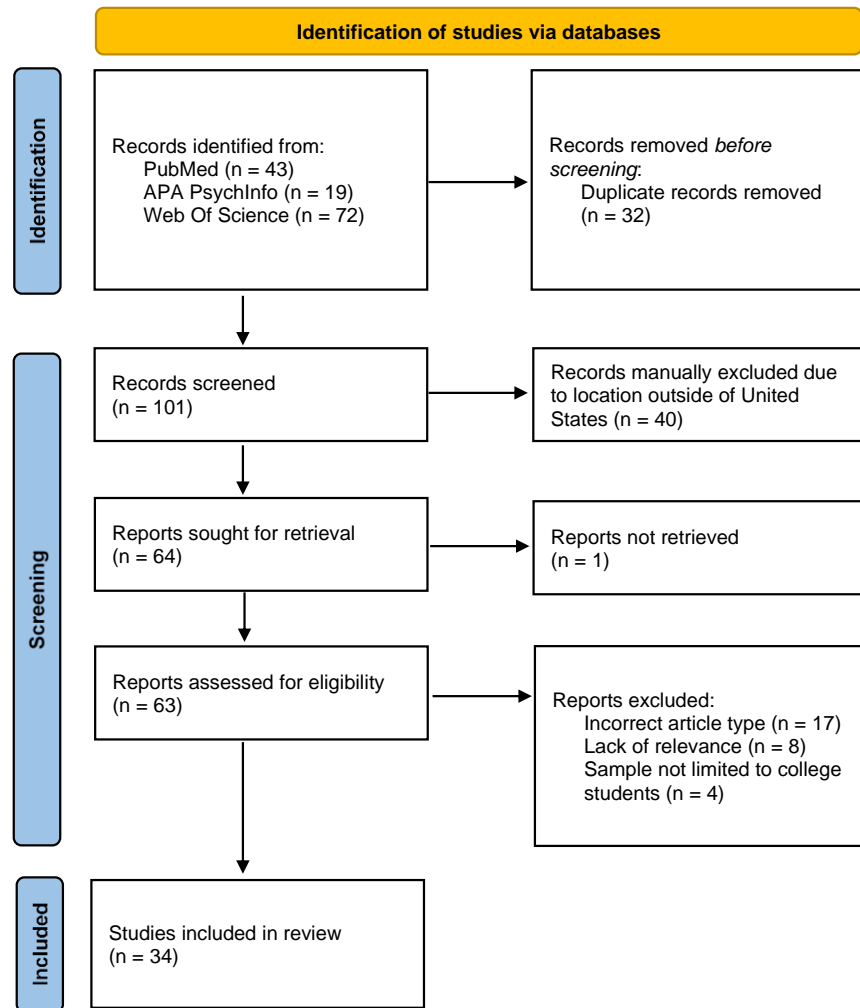


Figure 1. Study PRISMA Flow Diagram

3.2 Study Characteristics

3.2.1 Sample Characteristics

The number of subjects in the studies included ranged from 49 to 5,547, with an average of 766. 25 studies took place at one institution alone. Many of these institutions are located in the South (n=11) and Northeast (n=9) regions of the country. Two studies were conducted across more than one institution (Browning et al., 2021; Eden et al., 2020). Six studies recruited nationwide samples via social media, such as Facebook and Instagram (Cohen et al., 2020; Conrad et al., 2021; Firkey et al., 2021; Gonzales et al., 2020; Hoyt et al., 2021; Melcher et al., 2021).

All studies recruited full-time students and were typically open to all programs of study and both undergraduate and graduate levels. One study included examined only social work students (Lawrence et al., 2021). Articles on students in other health professions, such as medicine, nursing, and pharmacy, were typically commentaries or took place outside of the United States and were therefore excluded.

Percentage of female participants ranged from 42.4% (Eden et al., 2020) to 93% (Kibbey et al., 2021) with an average of 67.96%.

3.2.2 Study Designs

All 34 studies were observational in design. The majority of studies (n=24) were cross-sectional, with data collection between the months of March and August 2020. 11 studies were longitudinal in design (Copeland et al., 2021; Fruehwirth et al., 2021; Haft & Zhou, 2021; Hoyt et al., 2021; Huckins et al., 2020; Kleiman et al., 2020; Krendl, 2021; Maher et al., 2021; Melcher et al., 2021; Rettew et al., 2021; Wang et al., 2020). Of these, eight studies included baseline data from before the COVID-19 outbreak was classified as a pandemic by the World Health Organization in March 2020 (Copeland et al., 2020; Fruehwirth et al., 2021; Haft & Zhou, 2021; Huckins et al., 2020; Krendl, 2021; Maher et al., 2021; Zhang et al., 2020). Of the longitudinal studies, six utilized surveys alone (Fruehwirth et al., 2021; Haft & Zhou, 2021; Hoyt et al., 2021; Krendl, 2021; Maher et al., 2021; Wang et al., 2020) and five utilized Ecological Momentary Assessments (EMA) (Copeland et al., 2021; Huckins et al., 2020; Kleiman et al., 2020; Melcher et al., 2021; Rettew et al., 2021). EMAs involved repeated sampling of behaviors and experiences in real time. These required access to a mobile application on a smartphone through which participants could answer daily questions and researchers could collect anonymized data. Response rates of longitudinal studies ranged from 30.6% to 100%, with an average of 73.53% follow-up. Overall, two surveys included an interview component that was conducted virtually (Melcher et al., 2021; Son et al., 2020).

Most survey questionnaires (n=29) included at least one standard validated scale to assess for symptoms of depression or anxiety or experiences of stress. Other survey questions addressed other aspects of student experiences such as stress-reducing behaviors, socioeconomic and academic disruptions, and COVID-19-related concerns. Likert scales were used more often than open-ended free response answer formats.

3.2.3 Commonly Used Measures

Commonly used measures included in surveys were analyzed and are summarized below.

Patient Health Questionnaire. Depressive symptoms were assessed by eight studies using long forms of the Patient Health Questionnaire (PHQ) (Conrad et al., 2021; Fruehwirth et al., 2021; Krendl, 2021; Lawrence et al., 2021; Lechner et al., 2020; Melcher et al., 2021; Wang et al., 2020; Zhang et al., 2020). The 9-item PHQ (PHQ-9) is widely used in primary care settings to screen for depression and has demonstrated very good internal consistency with a Cronbach alpha of 0.89 (Kroenke et al., 2001). Participants were asked to rate on a 4-point Likert scale how often they experienced depressive symptoms over the past two weeks. Of these studies, five utilized the full 9-item questionnaire, while three used the 8-item version, which omits the item regarding suicidal ideation. Possible scores range from 0 to 27. Scores from 5 to 9, 10 to 14, 15 to 19, and 20 to 27 indicate mild, moderate, moderately severe, and severe depression, respectively.

Generalized Anxiety Disorder Scale. Anxiety symptoms were assessed by ten studies using the 7-item Generalized Anxiety Disorder Scale (GAD-7) (Biber et al., 2020; Conrad et al., 2021; Fruehwirth et al., 2021; Hoyt et al., 2021; Krendl, 2021; Lawrence et al., 2021; Lechner et al., 2020; Melcher et al., 2021; Wang et al., 2020; Zhang et al., 2020). This questionnaire is used in primary care settings to screen for generalized anxiety disorder and has demonstrated excellent internal consistency with a Cronbach alpha of 0.92 (Son et al., 2020). Participants were asked to rate on a 4-point Likert scale how often they experienced anxiety symptoms over the past two weeks. Possible scores range from 0 to 21. Scores from 6 to 10, 11 to 15, and 16 to 21 indicate mild, moderate, and severe anxiety, respectively.

The PHQ-4 is a shorter 4-item screening tool that comprises of two screening questions from each of the previous scales. The PHQ-4 was used by three studies (Eden et al., 2020; Haliwa et al., 2021; Hoyt et al., 2021).

Perceived Stress Scale. Levels of stress were assessed by nine studies using the Perceived Stress Scale (PSS) (Eden et al., 2020; Hathaway et al., 2021; Hoyt et al., 2021; Kecojevic et al., 2020; Krendl, 2021; Melcher et al., 2021; Son et al., 2020; Trammell et al., 2021; Zhen et al., 2021). The 10-item PSS (PSS-10) has demonstrated good internal consistency with a Cronbach alpha of 0.84-0.85 in college student samples as well as good validity with a positive correlation with scores on life event scales (Cohen et al., 1983). Participants were asked to rate on a 5-point Likert scale how often they felt or thought a certain way in the past month. Items numbered 4, 5, 7, and 8 were reverse scored. Possible scores range from 0 to 40. PSS does not have official score cutoffs for classification of severity, but higher scores indicate a higher level of perceived stress.

Other scales were administered relatively frequently. The Multidimensional Scale of Perceived Social Support was used by four studies to assess for perceived support from family, friends, and significant others (Fruehwirth et al., 2021; Haliwa et al., 2021; Hathaway et al., 2021). The Depression Anxiety and Stress Scale is a widely used screening tool that was administered in three studies, only one of which supplemented it with PHQ and GAD (Haliwa et al., 2021; Kibbey et al., 2021; Melcher et al., 2021). The Brief Resilience Scale was used by three studies to measure resiliency (Eden et al., 2020; Fruehwirth et al., 2021; Hunt et al., 2021). The University of California, Los Angeles Loneliness Scale was used by three studies that characterizes how much a person feels socially disconnected from others (Conrad et al., 2021; Krendl, 2021; Melcher et al., 2021).

3.3 Thematic Analysis

Four broad themes were identified across the 34 publications and were used to organize the review: (a) mental health in the general student population, (b) mental health in specific subgroups, (c) health-related behaviors, and (d) socioeconomic implications.

3.3.1 Mental Health in the General Student Population

Review of titles, abstracts, and methods revealed that 14 studies investigated mental health as the primary research topic, with the objective to determine the severity of psychological distress and its manifestations as symptoms of depression or anxiety.

Almost all 14 publications showed that students overall were experiencing high levels of distress in the early stages of the pandemic. The frequency of students expressing increased levels of stress ranged from 14.6% (Browning et al., 2021) to as high as 71% (Son et al., 2020; Wang et al., 2020). Average PSS10 scores ranged from 18.8(4.9) (Son et al., 2020) to 30.26(6.41) (Krendl, 2021), indicating at least a moderate level of perceived stress. Two longitudinal studies taking place from January to May 2020 showed that stress levels were the same (Copeland et al., 2021) or lower (Rettew et al., 2021) during the start of the pandemic as compared to the months prior. Another longitudinal study showed that overall stress levels were particularly high in April 2020 and slightly declined in July 2020 (Hoyt et al., 2021).

Six studies collected qualitative descriptions of stressors (Browning et al., 2021; Hoyt et al., 2021; Jones et al., 2021; Lawrence et al., 2021; Molock & Parchem, 2021; Son et al., 2020). Common stressors that students experienced included fear and worry about their own or family members' risks of being infected with COVID-19, difficulty concentrating, decreased social interactions, concerns regarding academic plans or performance, and concerns about obtaining basic needs (Browning et al., 2021; Jones et al., 2021; Son et al., 2020). Students have described changes to their daily life pertaining to their general behaviors and financial and living situations during school closures. Anecdotal samples included in articles highlighted the complexity of cumulative stressors such as loss of employment, lack of assistance for tuition, housing insecurity, caretaking responsibilities, class workload, and changes to or loss of access to mental health services and peer support (Hoyt et al., 2021).

Risk factors for stress were investigated in several studies through exploratory analysis. Females were found to be associated with greater perceived stress (Browning et al., 2021; Hathaway et al., 2021; Hoyt et al., 2021; Jones et al., 2021; Kecojevic et al., 2020; Kibbey et al., 2021). Students from lower socioeconomic status reported higher perceived stress and anxiety in the first months of the national public health emergency (Browning et al., 2021; Haliwa et al., 2021; Hoyt et al., 2021). However, one longitudinal study continuing into the summer of 2020 found no statistically significant changes in perceived stress or anxiety by race/ethnicity or income level (Hoyt et al., 2021). High risk of distress was also associated with knowing someone infected with COVID-19, personally experiencing respiratory viral symptoms or a greater perceived risk of contracting COVID-19 ((Browning et al., 2021; Haliwa et al., 2021; Kibbey et al., 2021; Trammell et al., 2021). A pre-existing psychiatric diagnosis was significantly associated with experiencing more symptoms of depression, anxiety, and post-traumatic stress disorder (Cohen et al., 2020).

Protective factors for psychological health were investigated as well. Higher levels of mindfulness and social support were identified as protective factors for mental health in terms of reporting less perceived stress, greater happiness, and greater life satisfaction (Haliwa et al., 2021; Szkody et al., 2020; Zhen et al., 2021). Personality traits were also found to contribute to the ability to cope with major stressful events. For example, extraversion was negatively associated with mood indices but positively associated with engagement in healthy activities (Rettew et al., 2021).

Stress was associated with worse mental health outcomes during the pandemic. Symptoms of depression and anxiety were universally reported at high rates. Among all publications, PHQ scores ranged from 6.22 (Fruehwirth et al., 2021) to 9.44 (Lechner et al., 2020), and GAD scores ranged from 5.41 (Fruehwirth et al., 2021) to 10.49 (Hoyt et al., 2021) in the early stages of the pandemic. Four longitudinal studies demonstrated an increase in these scores as the pandemic initially progressed (Fruehwirth et al., 2021; Krendl, 2021; Lawrence et al., 2021; Zhang et al., 2020). The frequency of anxiety symptoms was positively correlated with the daily number of new cases and deaths due to COVID-19 in April and May 2020 (Huckins et al., 2020; Kleiman et al., 2020).

3.3.2 Mental Health in Specific Subgroups

Five publications focused on specific subgroups regarding demographics such as race/ethnicity and sexual/gender identity as the primary research topic (Gonzales et al., 2020; Haft & Zhou, 2021; Hunt et al., 2021; Molock & Parchem, 2021; Trammell et al., 2021).

Three studies examined racial or ethnic minorities (Haft & Zhou, 2021; Molock & Parchem, 2021; Trammell et al., 2021). A cross-sectional survey of undergraduate students of color enrolled in a diversity mentorship program highlighted that these students endured disruptive changes in finances, living situation, academic performance, education plans, and career goals (Molock & Parchem, 2021). One study found no statistically significant ethnic/racial differences in perceived stress, perceived COVID-19-related depression, health-related behaviors, or overall COVID-19 mental health impacts (Trammell et al., 2021). In this study, however, Hispanic/Latinx and Asian students perceived higher COVID-19-related threat and held more negative health beliefs than White students; Latinx students reported higher financial and resource impact scores than White students; and Asian students were significantly more likely than White students to report witnessing or experiencing discrimination.

One study found that relatively few participants, most of which identified as Asian, reported experiencing racial discrimination in April 2020 (Cohen et al., 2020). When surveying ethnically diverse students, the majority of these individuals personally experienced or witnessed discrimination against individuals of Asian descent followed by Black descent (Molock & Parchem, 2021). A longitudinal study of Chinese students in California revealed higher perceived discrimination and anxiety during the pandemic when compared to prior to the pandemic (Haft & Zhou, 2021). After controlling for overall media exposure, the relationship between the pandemic and perceived discrimination was partially mediated by exposure to media that negatively portrayed Chinese

individuals. These are notable findings, as one study found that Asian students experienced higher levels of psychological impact compared to White students (Browning et al., 2021). On the contrary, another study found that Asian students reported fewer anxiety symptoms than White students (Hoyt et al., 2021).

Female and sexual/gender minority individuals were shown to be at highest risk for increases in depression and anxiety across longitudinal studies (Fruehwirth et al., 2021). Two studies focused on members of the lesbian, gay, bisexual, transgender, queer, and/or questioning (LGBTQ) community (Gonzales et al., 2020; Hunt et al., 2021). Both studies found that nonbinary individuals reported higher psychological distress than binary individuals. Almost half of LGBTQ college students (45.7%) reported having families that do not support or know of their LGBTQ identity, and these students were more likely to experience frequent distress when compared with students who reported having supportive families (Gonzales et al., 2020). The majority of these respondents (58.5%) indicated that they would be able to receive mental health care if needed. However, 12.8% of respondents indicated that stay-at-home orders prevented their ability to receive mental health care services.

3.3.3 Health-related Behaviors

Behavior changes in response to the pandemic were found to be pervasive throughout the studies. Students almost universally adopted public health recommendations of physical distancing, regular hand hygiene, and face protection (Cohen et al., 2020; Kecojevic et al., 2020; Szkody et al., 2020). In qualitative sections of cross-sectional surveys, students mentioned several coping strategies such as ignoring the news, using other media, turning to social support, drinking alcohol, meditating, and engaging in physical exercise (Browning et al., 2021; Son et al., 2020). Physical activity was positively associated with positive affect during COVID-19 stay-at-home orders (Maher et al., 2021). Two longitudinal studies found that students were more sedentary as the outbreak progressed during the Spring 2020 semester (Huckins et al., 2020; Maher et al., 2021). Though, one cross-sectional study found that moderate-to-vigorous physical activity did not significantly decrease among social work students during the pandemic (Lawrence et al., 2021).

Four studies revealed students had poorer sleep quality during the pandemic (Firkey et al., 2021; Maher et al., 2021; Melcher et al., 2021; Tasso et al., 2021). Two studies reported that students were getting fewer hours of sleep (Copeland et al., 2021; Son et al., 2020), and one study found no difference in hours of sleep across the Spring 2020 semester (Huckins et al., 2020).

Although college students have recently shown higher rates of disordered eating behaviors as compared to the general population (Rodgers et al., 2020), change in eating patterns during the pandemic was not studied extensively in the included articles. Few studies highlighted examples such as inconsistent eating, increased or decreased appetite, and emotional eating (Son et al., 2020; Wang et al., 2020).

Four studies examined screen time and use of media as a coping tool (Browning et al., 2021; Eden et al., 2020; Kecojevic et al., 2020; Zhen et al., 2021). The intensity of anxiety was associated with spending more than one hour per day searching for information on COVID-19 in April 2020 (Kecojevic et al., 2020). Depression and anxiety were positively correlated with screen time (Browning et al., 2021; Lawrence et al., 2021; Wang et al., 2020) and use of media (Eden et al., 2020). Results from one study suggested that spending two or more hours outdoors daily was associated with lower levels of psychological impact and eight or more hours of screen time daily was associated with higher levels of psychological impact (Browning et al., 2021). However, one study suggested that some media coping strategies were associated with positive affect, positive mental health, and flourishing (Eden et al., 2020). Both anxiety and depression were significantly associated with COVID-19-related news. Increased phone use and decreased physical activity were associated with fluctuations in COVID-19 news reporting (Huckins et al., 2020).

The amount and frequency of alcohol consumption was found to increase during the first month of the pandemic in four studies (Eden et al., 2020; Firkey et al., 2021; Jones et al., 2021; Lechner et al., 2020). The number of reported depressive and anxiety symptoms was positively correlated with alcohol consumption, whereas the level of perceived social support was negatively correlated with alcohol consumption (Lechner et al., 2020). One study found that feelings of COVID-19-related anxiety were associated with a greater desire to drink alcohol and use drugs (Kleiman et al., 2020), and two found that students reported increases in use of recreational drugs such as cannabis (Firkey et al., 2021; Jones et al., 2021). Yet, one study reported that alcohol consumption did not significantly increase among social work students (Lawrence et al., 2021).

3.3.4 Socioeconomic Implications

Several studies focused on the psychosocial impact of the pandemic on areas such as disruptions in income, housing, food security, and academic experiences. A considerable portion of students reported a reduction in household income (Cohen et al., 2020; Firkey et al., 2021; Hoyt et al., 2021; Jones et al., 2021; Owens et al., 2020; Son et al., 2020). Open-ended responses further revealed concerns about expenses for food, rent, tuition, and medical expenses (Hoyt et al., 2021; Jones et al., 2021; Son et al., 2020). Many students relocated in response to campus closures. A substantial number of students changed their living situation, with many moving in with parents (Conrad et al., 2021; Jones et al., 2021; Tasso et al., 2021). The majority of students reported living with parents during initial stay-at-home orders (Cohen et al., 2020; Conrad et al., 2021; Lawrence et al., 2021; Son et al., 2020; Szkody et al., 2020; Tasso et al., 2021; Zhen et al., 2021).

Three studies screened for food insecurity (Jones et al., 2021; Maher et al., 2021; Owens et al., 2020). Two cross-sectional surveys highlighted that one-third to one-half of students experiencing food insecurity (Jones et al., 2021; Owens et al., 2020). One longitudinal study revealed no significant change in food security during the first two months of pandemic when compared to food security over

the preceding year (Maher et al., 2021). Identification as a racial/ethnic minority or single parent, change in living situation, or loss of employment during the global outbreak were strongly associated with food insecurity (Owens et al., 2020). Moreover, strong predictors of anxiety or depression included high levels of food and housing insecurity (Jones et al., 2021).

Lastly, organizational changes during the pandemic had consequences on academic progress and added uncertainty about career prospects. No objective measures of academic performance or enrollment have been used; however, students have consistently reported increased concerns about difficulty concentrating on course work and dissatisfaction with changes to the learning environment (Kecojevic et al., 2020; Son et al., 2020; Wang et al., 2020). College students indicated some level of fear and worry about their academic progress and future career plans (Cohen et al., 2020; Lawrence et al., 2021; Melcher et al., 2021; Rettew et al., 2021). For example, summer internships and other opportunities to gain work experience were cancelled, thereby limiting professional development during these times (Molock & Parchem, 2021; Son et al., 2020). It is currently unclear to what extent these consequences will affect young adults entering the workforce.

4. Discussion

4.1 Summary of the Evidence

The purpose of this review is to summarize the current understanding of well-being in college students during the COVID-19 pandemic. With school closures and stay-at-home orders, students have had to adapt to new environments, such as virtual classes and meetings and different living situations. National and regional studies across the United States have examined the mental health burden among students in higher education. Thematic analysis revealed several emerging themes from challenges that students face and their attempts to cope with hardships.

Students endured employment losses, housing changes, and difficulty meeting basic needs on top of the transition to online learning. Generally, a great deal of students was shown to experience a moderate level of stress as soon as American institutions started addressing the outbreak. Common stressors included social isolation, fear of becoming infected with COVID-19, financial strain, and uncertainty about the future. Only two longitudinal studies showed a decline or no change in perceived distress across the Spring 2020 semester, the academic term disrupted by abrupt changes to course delivery, campus services, and lockdowns (Copeland et al., 2021; Rettew et al., 2021). One study showed a marginal decline in stress levels into the summer months (Hoyt et al., 2021). As of yet, no other trends have been reported in later months.

The average severity of depression or anxiety experienced in samples that measured PHQ or GAD scales were classified as mild. While this may be interpreted as subclinical depression or anxiety, these average scores indicate poor psychological health at the community level that may be addressed with institutional support and interventions. Of course, recommendations should be tailored to each

individual, and those with clinically severe psychiatric conditions may benefit from seeking professional treatment. The increased need for mental health services suggests that universities should seek ways to increase access to these services for their students.

Several studies found increased severity of stress and psychiatric symptoms in females and LGBTQ individuals. However, females were overrepresented in several samples, and this imbalance may skew analyses. There is mixed evidence on racial/ethnic disparities in mental health burden, and researchers sought to examine these nuances in different ways. While some aspects of psychological responses to the pandemic may have been universal (Trammell et al., 2021), racial discrimination and financial impact was more likely to be reported among certain racial/ethnic groups. In particular, Asian, Black, and Latinx groups were emotionally affected by current events regarding anti-Asian and anti-Black violence (Cohen et al., 2020; Molock & Parchem, 2021).

Behavior changes varied across studies. Variations in mental health and behaviors, including screen time and use of media, fluctuated with the dynamic situation of the pandemic (Browning et al., 2021; Eden et al., 2020; Huckins et al., 2020; Kecojevic et al., 2020; Lawrence et al., 2021; Wang et al., 2020). Changes in physical activity were mixed across studies and may be owed to the fact that these activities largely depend on the home environment, available facilities, personal preferences, and concerns for health safety. Given that many students changed their living situation while schools and businesses were not physically operating, students were driven to seek safe, alternate avenues for physical activity. Lack of motivation, a common symptom of depression, may contribute to reduced physical activity as well. Students reported poor quality of sleep (Firkey et al., 2021; Maher et al., 2021; Melcher et al., 2021; Tasso et al., 2021) and altered eating habits (Son et al., 2020; Wang et al., 2020) during the pandemic. Disturbances in sleep and eating patterns are also common symptoms of depression, but these may also be affected by external factors such as housing and food insecurity.

Use of alcohol and recreational drugs was shown to increase in five of six studies (Eden et al., 2020; Firkey et al., 2021; Jones et al., 2021; Kleiman et al., 2020; Lawrence et al., 2021; Lechner et al., 2020). One disadvantage is that these results were typically collected in cross-sectional studies, which lack an objective baseline, but one study was able to record self-reports of substance use in real time via EMAs (Kleiman et al., 2020). Under-reporting is a concern for self-reporting of drug use (Bone et al., 2016). There is not enough evidence to conclude long-term implications of these behavior changes, however the current literature captures an intricate account of the student experience at the beginning of the public health emergency.

Most studies were launched at 4-year universities, so community college students may not have been represented heavily. Study design varied greatly as well, particularly in terms of survey measures of demographics, psychological health, and behaviors. Scales are useful in quantifying attitudes, maximizing response rate, and ensuring consistency in data reporting. Quantification allows for rigorous statistical analysis to test several hypotheses. Open questions may be more time-consuming

and reduce rates of survey completion. However, free responses have provided a more complex and human narrative of student experiences. All studies relied on self-reported data and could be susceptible to recall bias. EMAs have the advantage of frequent sampling over time, which can minimize recall bias and maximize validity by capturing data in real time (Shiffman et al., 2008). EMAs require smartphone compatibility, and caution must be taken to ensure data privacy.

4.2 Limitations

Limitations apply to this review. Inclusion criteria were relatively liberal to capture the wide perspective of available literature in the United States; specifically, a quality assessment tool was not used. Preliminary articles were not included, and the current study may not have captured latest research on data from the later stages of the outbreak. Substantial heterogeneity of methods (i.e., assessment tools, primary outcomes measured, data analysis) and data reporting was noted across the included studies. Authors of publications were not contacted for raw data or confirmation of results. All articles relied on self-reported data, thereby increasing the risk of recall bias, particularly in cross-sectional studies and assessments using large retrospective timeframes.

Owing to the breadth of the chosen research topic, many factors were not assessed in depth in this review, including somatic manifestations of stress (i.e., headaches, change in bowel habits), caretaking responsibilities, first-generation college student status, and domestic violence. These are important physiologic and socioeconomic characteristics to consider in future research. Other demographic features, such as city of residence and year in program of study, were not analyzed in the review.

In the current review, quantitative synthesis was not conducted, and study findings were summarized in a narrative fashion. As with observational studies generally, causality cannot be concluded from studies included in this review. Lastly, overrepresentation of female and White students was noted in several studies, introducing concern for sampling bias and indicating that presented findings may not be representative of the real collegiate population. Large population-based studies may suffer from ecological fallacy, and inferences about individuals cannot be made based on aggregate data.

5. Conclusions

College students in the United States have experienced a great deal of biopsychosocial stress during the era of COVID-19. There is concern for a “dual pandemic” pertaining to mental health and social isolation. The volume of literature on well-being in young adults during these times is expanding globally from various disciplines. University students are becoming increasingly recognized as a vulnerable subpopulation suffering from high rates of depression, anxiety, and substance use. These conditions are all risk factors for suicide and should be taken seriously.

The mental health burden of American collegiate is extensive, certain subgroups are vulnerable to greater impact, students have changed their behaviors in many ways, and the pandemic has impacted student’s financial and living situations. Some demographic subgroups (e.g., sexual/gender and

racial/ethnic minorities, and low socioeconomic status) experienced greater hardships than others. For some, the university setting provides access to various resources, including food, stable housing, access to online learning technology, work experience, and peer support.

Changes brought about by the COVID-19 pandemic affected all aspects of social determinants of health: economic stability, community and social context, neighborhood and built environment, health care, and education. Studies have enumerated factors such as loneliness, distress tolerance, and family support as potential risk and protective factors for psychological health outcomes.

Studies have highlighted the need for tangible institutional support, including tuition relief and greater access and affordability of mental health services, particularly for vulnerable populations, to reduce the adverse psychological impact of the COVID-19 pandemic. Universities may consider offering more targeted services or utilizing mobile health technology in order to promote healthy stress coping techniques.

Studies included in the review took place in the spring and summer of 2020, with the latest data collection ending in August 2020. As COVID-19 vaccinations become more widely available, it will be helpful to assess how vaccination status affects mental health and behaviors as well. As the pandemic continues to evolve, ongoing psychological and economic effects of the pandemic should continue to be monitored. There is a need for more high-quality large-scale longitudinal studies that examine differences in mental health outcomes based on risk factors such as racial/ethnic and sexual/gender identity as well as socioeconomic status. More consistent survey measures, particularly highly validated quantitative assessments of psychosocial profiles, should be utilized.

The long-term impact of COVID-19-related stress on physical health may take months to years to become fully apparent. Chronic distress has been associated with an increased risk of chronic diseases such as hypertension, diabetes, and cardiovascular disease. Early detection of these problems at the population level is essential to optimizing management, identifying disparities, and informing health promotion and disease prevention strategies. Health care systems and educational institutions should be prepared to address socioeconomic impacts beyond the immediate academic terms.

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Appendix

Appendix A. Study Characteristics

Study	Summary of Findings	Design (Dates of Data Collection)	Location	Measures	Demographics
Biber et al., 2020*	There was a negative correlation between anxiety and optimism ($r=-0.36$), gratitude ($r=-0.12$), and perceived effectiveness of academic instruction ($r=-0.11$). Average GAD7 score of all respondents was 6.96(6.27). Students with higher GAD7 scores perceived lower effectiveness of institutional response to COVID-19 when compared to mildly or moderately anxious respondents [$F(2,1516)=10.60$, $p<0.001$].	Cross-sectional, Survey (April 2020)	GA	GAD7, Revised Life Orientation Test, Gratitude Questionnaire 6. Questions about perceived instructional response	N=1640. 60.3% female. 61.4% White, 24.7% Black
Brownin g et al., 2021	In open-ended responses, respondents reported symptoms of depression (27.3%) and anxiety (17.4%) and perceptions of stress (14.6%). Bivariate associations showed students who were female, were Asian, in fair/poor health, of below-average relative family income, or who knew someone infected with COVID-19 experienced higher levels of psychological impact. Students who were White, higher socioeconomic status, spent at least two hours outside, or less than eight hours on electronic screens were likely to experience lower levels of psychological impact. Multivariate modeling showed that being a female, having fair/poor general health status, spending 8 or more hours on screens daily, and knowing someone infected predicted higher levels of psychological impact when risk factors were considered simultaneously.	Cross-sectional, Survey (March-May 2020)	Various (7 universities)	Positive and Negative Affect Schedule, Penn State Worry Questionnaire. Questions about behaviors	N=2534. 61% female. 79% White. 20% graduate
Cohen et al., 2020	Personal experiences and attitudes regarding COVID-19 during February through April 2020 were surveyed. 35% of respondents had experienced any COVID-19-related symptoms, less than 5% had gotten tested. Participants were more stressed about the disease's health implications for their family and American society than for themselves.	Cross-sectional, Survey (April 2020)	Various (nationwide)	Questions about COVID-19 symptoms, socioeconomic impacts	N=725. 60.7% female. 63.2% White, 8% Black, 13.9% Hispanic, 24.3% API

Conrad et al., 2021	33.38% of respondents reported being mandated to relocate. 86.4% reported living with parents/guardians. Total average PHQ8 score was 9.28(5.65). Total average of GAD7 score was 9.47(5.63). After controlling for the severity level of local COVID-19 outbreaks, respondents who relocated reported greater COVID-19-related grief, loneliness, and anxiety symptoms, compared to respondents who did not relocate. Gender diverse individuals were more likely to report depressive, anxiety, and PTSD symptoms compared to men ($p<0.05$). A pre-existing psychiatric diagnosis was significantly associated with depressive, anxiety, and PTSD symptoms ($p<0.001$).	Cross-sectional, Survey (April-August 2020)	Various (nationwide)	COVID-related worry, COVID-related grief, UCLA Loneliness Scale, PHQ8, GAD7, PTSD Checklist—Civilian Version, Distress Tolerance Scale, Connor-Davidson ResilienceScale. Questions about relocation and socioeconomic impacts	N=791. 82.2% female, mean age 23.07(3.18). 59.7% White, 4.8% Black, 5.8% Hispanic, 21.0% Asian. 61.9% undergraduate
Copeland et al., 2021	Daily mood ($\beta=-0.1$, $p=0.003$) and health-related behaviors ($\beta=-0.06$, $p=0.036$) were negatively affected by the pandemic, but stress ($\beta=0.02$, $p=0.58$) was not. The overall magnitude of these changes were modest but persistent across the Spring 2020 semester and differed from patterns observed in a prior year. Externalizing and attention problems increased during the pandemic, but not internalizing symptoms. Students enrolled in a wellness program reported less internalizing and attention problems compared to those not enrolled in a wellness program. The majority of respondents (68.4%) reported they were not confident in the government's response to the pandemic.	Longitudinal, Survey, EMA (January-May 2020)	VT	Brief Problem Monitor, Questions about COVID-19 perceptions, mood, stress levels, wellness index based on exercise, nutrition, sleep, hydration, screen time	N=675, 576. 74.1% female. 89.5% White, 0.7% Black, 3% Hispanic, 4.2% Asian
Eden et al., 2020	Anxiety was associated with increased use of media ($p<0.05$). Stress was associated with more hedonic ($p<0.05$) and less eudemonic ($p<0.05$) media use. Avoidant coping was associated with poorer mental health, whereas humor coping was associated with better mental health. Resilience positively moderated the effect of stress on problem-focused, avoidant, reframing, and humor coping.	Cross-sectional, Survey (March-April 2020)	Various (MI, FL)	PSS14, Brief COPE, Basic Psychological Need Satisfaction, Life Orientation Scale, Hope Scale, Brief Resilience Scale, Scale of Positive and Negative Experience, Flourishing Scale, Mental health subscale of SF36	N=425. 68.5% female, mean age 20.19(2.18). 78.1% White, 8.5% Black, 11.5% Hispanic, 12.7% Asian
Firkey et al., 2021*	Most students reported a decrease in quality of life (71.7%), an increase in levels of anxiety (63.7%), concerns with meeting basic resource needs (53.8%), and a decrease in sexual activity (57.5%). 26.9% and 15.1% of students reported increases in alcohol and cannabis use, respectively.	Cross-sectional, Survey (May-July 2020)	Various (nationwide)	Pandemic Stress Index, AUDIT-C. Questions about COVID-19 beliefs, behaviors	N=212. 50.5% female, mean age 22, 70.8% White

Fruehwirth et al., 2021	Prevalence of moderate to severe depression increased from 21.5% in Fall 2019 to 31.7% in Spring-Summer 2020 ($p<0.001$). Prevalence of moderate to severe anxiety increased from 18.1% to 25.3% ($p<0.05$). White, female, and sexual/gender minority students were at highest risk for increases in anxiety symptoms. Black, female and sexual/gender minority students were at highest risk of increases in depression. Loss of work and COVID-19 diagnosis or hospitalization of oneself, family members, or friends were not associated with increases in depression or anxiety symptoms.	Longitudinal, Survey (October 2019-July 2020)	NC	PHQ8, GAD7, Brief Resilience Scale, MSPSS. Questions about COVID-19 stressors, socioeconomic impacts	N=966, 419. Mean age 18.9(0.1), 61.6% White, 6.7% Black, 18.1% API, 8.4% Hispanic
Gonzales et al., 2020	The majority of respondents reported experiencing depressive symptoms (60.4%) anxiety symptoms (65%) and frequent distress (61%). Compared to cisgender men, transgender students were much more likely to report frequent distress (aOR=3.41, CI 1.31, 8.86). 45.7% of LGBT college students have immediate families that do not support or know of their LGBT identity. LGBT students with unsupportive families were more likely to experience frequent distress (aOR=1.83, CI 1.13, 2.95).	Cross-sectional, Survey (April-June 2020)	Various (nationwide)	PHQ4. Questions about LGBT experiences, socioeconomic impacts, barriers to mental health care	N=477. 25.2% nonbinary, 42.4% female, mean age 20.7, 61.2% White, 9.2% Black, 13.2% Hispanic, 13.8% API
Haft & Zhou, 2021*	Chinese students were surveyed in Fall 2019 with a 47.76% follow-up response rate in Spring 2020. Respondents reported higher perceived discrimination and anxiety during the pandemic when compared to prior to the pandemic. Mediation analyses suggested that negative Chinese media exposure partly accounted for the group difference in perceived discrimination.	Longitudinal, Survey (September 2019-March 2020)	CA	Everyday Discrimination Scale, Beck Anxiety Inventory	N=134, 64. 55.6% female, mean age 20.01(1.31), 100% Asian
Haliwa et al., 2021*	Greater perceived risk of contracting COVID-19 was associated with greater depression, anxiety, and perceived stress. Greater mindfulness and social support were identified as protective factors for psychological health.	Cross-sectional, Survey (March-May 2020)	WV	DASS, MSPSS, Cognitive and Affective Mindfulness Scale Revised, Subjective Happiness Scale, Satisfaction with Life Scale, Questions about COVID-19 awareness and worries	N=251. 82.22% female, mean age 19.62(1.55), 89.69% White
Hathaway et al., 2021*	Undergraduate student respondents reported an average PSS10 score of 21.31(7.54). Females reported higher PSS10 scores compared to males ($Z=4.89$, $p<0.01$).	Cross-sectional, Survey (July-August 2020)	TN	PSS10 retrospectively "at the end of Spring 2020"	N=312. 74.7% female. 88% White, 3.2% Black, 2.9% Asian

Hoyt et al., 2021	Levels of anxiety and perceived stress were higher in April than in July 2020. Average GAD7 scores decreased from 10.49(5.95) to 9.85(6.04). Average PSS10 scores decreased from 22.72(9.00) to 20.36(8.06). Black and mixed race/ethnicity individuals were the only groups to show increased anxiety from April to July. Women reported worse well-being compared with men. Gender diverse and sexual minority youths reported worse outcomes than their cisgender heterosexual peers at both time points. Qualitative data illustrates educational, economic, and environmental stressors.	Longitudinal, Survey (April-July 2020)	Various (nationwide)	PSS10, GAD7. Questions about socioeconomic impacts	N=707. 61% female, mean age 20.0(1.3). 54.3% White, 5.2% Black, 8.9% Hispanic, 20.4% Asian, 10.1% mixed
Huckins et al., 2020	Both anxiety ($p<0.001$) and depression ($p=0.03$) were significantly associated with COVID-19-related news. Compared with prior academic terms, students were more sedentary, anxious, and depressed when the pandemic started. Increased phone usage, decreased physical activity, and fewer locations visited, were associated with fluctuations in COVID-19 news reporting.	Longitudinal, EMA (January-March 2020)	NH	PHQ4. Smartphone sensing data on sedentary time, sleep, location, and phone usage	N=217, 178. 68% female. Race/ethnicity not collected
Hunt et al., 2021*	Gender diverse individuals reported higher psychological distress ($M=12.33$, $SD=6.04$, $p<0.0001$) and lower psychological resilience ($M=2.88$, $SD=0.93$, $p<0.001$) than nonbinary individuals. Cohen's d comparing gender diverse individuals to male and female individuals was 0.66 and 0.70 for resilience and distress, respectively. 48.2% of gender diverse individuals were above the cutoff for severe psychological distress.	Cross-sectional, Survey (March-April 2020)	OH	Brief Resilience Scale, Kessler Psychological Distress Scale. Perceived COVID-19 risk	N=5547 14.96% nonbinary ($n=83$, comparisons matched with 83 male and female)
Jones et al., 2021*	54.5% of respondents reported experiencing anxiety and/or depression, with 43.2% reporting anxiety and 42.2% reporting depression in April 2020. 49.0% reported an increased need for mental health services. 81.1% reported loss of household income and 49.8% reported worries about losing housing. High levels of food ($aPR=1.4$, CI 1.2, 1.6) and housing ($aPR=1.3$, CI 1.2, 1.4) insecurity were the strongest predictors of anxiety or depression.	Cross-sectional, Survey (April 2020)	NY	CDC Health-related Quality of Life Healthy Days Core Module, PHQ4, USDA Food Security Survey. Questions about COVID-19 symptoms, socioeconomic impacts	N=2282. 57.9% female. 23% White, 24.9%, Black, 29.4% Hispanic

Kecojević et al., 2020	Students reported several difficulties and high levels of perceived distress with a total average PSS10 score of 20.6(7.3). High levels of depression were associated with difficulties in focusing on academic work and employment losses. High levels of anxiety were more likely to be reported by upperclassmen and those who spent more than one hour per day searching for information on COVID-19. Difficulty focusing on academic work was associated with higher levels of somatization. Respondents with higher perceived stress were more likely to be female, unable to focus on academic work, and report difficulties obtaining medications and cleaning supplies.	Cross-sectional, Survey (April 2020)	NJ	PSS10, Brief Symptom Inventory. Questions about knowledge of COVID-19, behaviors, socioeconomic impacts	N=162. 71% female, mean age 20.4(2.9). 37% White, 25.3% Black, 26.5% Hispanic, 7.4% Asian
Kibbey et al., 2021	46.0% of respondents reported experiencing elevated psychological distress, with reports of anxiety (30.3%) and depression (25.4%). High risk of distress was associated with female sex, a COVID-19 case in the immediate social network, underlying medical conditions, and recent experience of 3 or more viral symptoms.	Cross-sectional, Survey (April-May 2020)	NJ	DASS, Short Health Anxiety Inventory. Questions about COVID-19 stressors, medical history checklist	N=641. 72.7% female, mean age 20.1(2.11). 49% White, 6.6% Black, 15.1% Hispanic, 31.9% Asian
Kleiman et al., 2020	78.5% of respondents indicated at least some level of anxiety about COVID-19. Structural change analyses indicated a downward trend in COVID-19-related anxiety after the first week of June 2020, with more than 15% of participants reporting high levels of anxiety at the lowest points. Anxiety was correlated with daily number of new cases and death due to COVID-19. Reportings of anxiety were associated with a greater desire to drink and use drugs. Optimism about COVID-19 was associated with receiving support from others and from their university.	Longitudinal, EMA (April-May 2020)	NJ	Questions about affect, knowledge/awareness about COVID-19	N=140. 77.6% female, mean age 19.98(1.61). 48.59% White, 7.04% Black, 36.62% API
Krendl AC, 2021*	Prior to the pandemic, stress mediated the positive relationships between loneliness and depression ($\beta=0.45$). 44% of respondents indicated that they had previously sought mental health treatment. During the pandemic, mental health outcomes, stress, and loneliness increased. PHQ8 scores increased from 5.85(5.09) to 8.91(5.42) ($p=0.009$), and GAD7 scores increased from 6.41(5.14) to 8.91(6.23) ($p=0.034$). PSS10 scores increased from 26.62(6.49) to 30.26(6.41) ($p=0.02$). Stress ($b>0.38$, $p<0.05$), but not loneliness, was associated with worse mental health outcomes during the pandemic.	Longitudinal, Survey (October 2019-March 2020)	IN	PHQ8, GAD7, PSS10, UCLA Loneliness Scale	N=111, 34. 54.96% female, mean age 19.09(1.38). 100% White

Lawrence et al., 2021*	There was a statistically significant increase in depression and anxiety scores in May through July 2020 when compared to retrospective self-reporting of scores for February 2020. Average PHQ9 increased from 3.63 to 9.10 ($p<0.0001$). Average GAD7 increased from 4.03 to 9.11 ($p<0.0001$). There was a significant increase in screen time during the pandemic ($p<0.0001$). Alcohol consumption did not significantly increase during the pandemic ($p=0.06$) and moderate-to-vigorous physical activity did not significantly decrease during the pandemic ($p=0.21$). Bivariate analyses showed a positive association between depression and anxiety with screen time and the transition to virtual classes.	Cross-sectional, Survey (May-July 2020)	FL	PHQ9, GAD7, Godin Leisure Time Exercise, AUDIT-C	N=88. 93% female, mean age 29(10.01), 61% White, 20% Hispanic. 100% social work students
Lechner et al., 2020	Amount and frequency of alcohol consumption increased during the first month of the pandemic. Greater number of depressive and anxiety symptoms were associated with increases in alcohol consumption compared to students with fewer symptoms. Students with greater perceived social support reported less alcohol consumption.	Cross-sectional, Survey (March 2020)	OH	Timeline Follow-Back Interview, PHQ9, GAD7, MSPSS	N=1958. 79.97% female, mean age 24.94(7.65). 86.41% White
Maher et al., 2021	Students exhibited significant reduction in physical activity, positive affect, and sleep quality, as well as an increase in negative affect during stay-at-home orders. Physical activity was positively associated with positive affect during COVID-19 stay-at-home orders ($\beta=0.01$, $p=0.01$).	Longitudinal, Survey (January-May 2020)	NC	Social Readjustment Rating Scale, Positive and Negative Affect Schedule, International Physical Activity Questionnaire, PSQI, US Household Food Security Survey Module, Social Readjustment Rating Scale	N=107. 66% female, mean age 21.7(2.6). 54% White, 35.5% Black, 12.1% Hispanic, 4.7% Asian
Melcher et al., 2021*	In-app daily mood assessments were strongly correlated with their corresponding gold standard clinical assessments. Total average PHQ9 was 8.58(5.33). Total average GAD7 was 6.50(5.03). Total PSS10 was 21.00(3.48). Sleep variance among students was correlated to depression scores ($p=0.28$) and stress scores ($p=0.27$)	Longitudinal, EMA, Interview (May-August 2020)	Various (nationwide)	DASS, PHQ9, GAD7, PSS10, UCLA Loneliness Scale, PSQI, Hamilton Depression Rating Scale, Flourishing Scale, Social Interaction Anxiety Scale, Social Functioning Scale, Health survey, Questions about COVID-19 symptoms, clinical global impression. Smartphone sensing data about screen time, location	N=100. 75% female, mean age 20.3. 63% White, 4% Black, 3% Hispanic, 20% Asian

Molock & Parchem, 2021*	Ethnically diverse students were surveyed. Respondents reported disruptive changes in finances (54%), living situation (35%), academic performance (46%), educational plans (49%), and career goals (36%). Psychological challenges included stress (41%), anxiety (33%), and depression (18%).	Cross-sectional, Survey (June 2020)	DC	Questions about socioeconomic impacts, behaviors	N=193. 49% female, mean age 20.52. 46% Black, 18% Hispanic, 21% Asian
Owens et al., 2020	34.5% of respondents were classified as food insecure within the last 30 days. Strong predictors of food insecurity include change in living situation (OR=2.70, CI 2.47, 2.96), being furloughed (OR=3.22, CI 2.86, 3.64), being laid off (OR=4.07, CI 3.55, 4.66), or losing part-time work (OR=5.73, CI 5.09, 6.46) during the pandemic.	Cross-sectional, Survey (May- June 2020)	TX	Food sufficiency screener, USDA Food Security Survey. Questions about financial and housing situation	N=651. 88% female. 40% White, 18% Black, 27% Hispanic, 11% Asian. 62% undergraduate
Rettew et al., 2021	Indices of mood ($\beta=-0.09$, $p<0.001$) and health-related behaviors ($\beta=-0.07$, $p<0.001$) declined during the study period and stress levels decreased ($\beta=-.04$, $p=.006$). Higher levels of extraversion were associated with decreases in mood indices ($\beta=-0.07$, $p<0.001$), whereas lower levels of extraversion were associated with slight increases in mood indices. Personality traits can contribute to ability to cope with major stressful events.	Longitudinal, Survey, EMA (January-May 2020)	VT	Big Five Inventory. Questions about mood and behaviors (daily ratings)	N=484. 76% female, mean age 18.08(0.3). >90% White
Son et al., 2020	71% of respondents reported increased stress and anxiety during the pandemic. Total average PSS10 score was 18.8(4.9). Common stressors include fear and worry about their health and of loved ones (91%), difficulty concentrating (89%), decreased social interaction due to physical distancing (86%), and increased concerns on academic performance (82%). Participants have adopted a variety of coping strategies. A vast majority of participants who indicated an increase in stress and anxiety (93%) reported that they had not used school counseling services during the pandemic.	Cross-sectional, Interview (April 2020)	TX	PSS10. Questions about coping mechanisms, health-related concerns, academic and socioeconomic impacts, barriers to mental health care	N=195. 57% female, mean age 20.7(1.7). Race/ethnicity not collected
Szkody et al., 2021*	Respondents reported social distancing or isolating for an average of 17.59(13.93) days. When accounting for length of time in self-isolation, perceived social support buffered the connection between COVID-19-related worries and psychological health.	Cross-sectional, Survey	MS	MSPSS, Inventory of Socially Supportive Behaviors, WHO Quality of Life Instrument	N=405. 65% female. 46.3% White, 11.1% Black, 0.5% Asian

Tasso et al.,2021	There was a positive relationship between academic frustrations and mental health symptoms. Worries about becoming infected with COVID-19 were positively correlated with mental health symptoms and negatively correlated with trust in the government.	Cross-sectional, Survey	NJ	Questions about COVID-19 stressors, perceived academic frustration, perceived mental health symptoms	N=257. 75% female
Trammel et al., 2021*	15.2% of respondents reported either being diagnosed with COVID-19 or experiencing viral symptoms, and there were no racial/ethnic disparities in this health outcome. Hispanic and Asian students experienced higher COVID-19-related threat and negative beliefs than White students. Total average PSS10 score was 28.59(8.45). 35% of respondents reported experiencing depressive symptoms, but there were no racial/ethnic differences in mental health symptoms or health-related behaviors.	Cross-sectional, Survey (May 2020)	CA	PSS14, Brief Illness Perception Questionnaire, Social Psychological Measurements of COVID-19, Epidemic-Pandemic Impacts Inventory	N=403. 74% female, mean age 20.4(1.5). 65% White, 6% Black, 10% Hispanic, 19% Asian. 100% undergraduate
Wang et al.,2020	48.14% of respondents reported moderate-to-severe depression, 38.48% reported moderate-to-severe anxiety, and 18.04% reported suicidal ideation. 71.26% of respondents indicated their stress levels increased during the pandemic. 43.25% reported being able to cope adequately.	Cross-sectional, Survey	TX	PHQ9, GAD7. Questions about COVID-19 stressors, behaviors, barriers to mental health care	N=2031. 61.64% female, mean age 22.8(5.52), 30.53% graduate. Race/ethnicity not collected
Zhang et al.,2020	49% and 53% of respondents reported an increase in PHQ9 and GAD7, respectively, over the course of the study. Greater late-night online activity volumes were positively correlated with increasing depression (r ranging between 0.32 and 0.75, $p<0.04$) and anxiety levels (r ranging between 0.39 and 0.74, $p<0.006$).	Longitudinal, Survey (January-May 2020)	NY	PHQ9, GAD7, Google/YouTube search activities	N=49. 61% female
Zhen et al.,2021	77.8% of respondents reported currently living with parents. Self-disclosure on social media ($\beta=-0.13$, $p<0.05$) and support from parents ($\beta=-0.15$, $p<0.05$) moderated levels of stress experienced by students.	Cross-sectional, Survey (April 2020)	CA	PSS adapted to COVID-19, Medical Outcomes Study Social Support Survey. Questions about socioeconomic impacts, behaviors with media	N=215. 79% female, mean age 20.5

*Denotes pre-print, non-peer-reviewed article.

CDC=Centers for Disease Control and Prevention; UCLA=University of California, Los Angeles;

USDA=United States Department of Agriculture; WHO=World Health Organization.

AUDIT-C=Alcohol Use Disorders Identification Test-Concise; DASS=Depression Anxiety and Stress Scale; GAD=Generalized Anxiety Disorder; MSPSS=Multidimensional Scale of Perceived Social Support; PHQ=Patient Health Questionnaire; PSS=Perceived Stress Scale; PSQI=Pittsburgh Sleep Quality Index. CI=confidence interval.