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College food insecurity (FI) and poor psychosocial health are prevalent public health issues in the U.S., yet often overlooked. Since the COVID-19 pandemic, repercussions on these critical inequity issues remain unclear. During the summer months of 2020, this cross-sectional survey examined associations between students' self-reported FI and perceived stress (PSS-10), one aspect of poor psychosocial health. Among respondents, 31.3% were food insecure and 37.8% were laid off or temporarily furloughed. This study adds important findings about college FI and perceived stress to the limited literature regarding college student health during the pandemic. A more rigorous study design with a larger, nationally or regionally representative sample is recommended for future studies. To address both complex issues of college FI and stress, a multifaceted interdisciplinary approach, well-supported by college administrators, would be warranted.

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Since March 2020, the COVID-19 pandemic has repeatedly shifted daily living. In response to the pandemic, the Centers for Disease Control and Prevention (2020) recommended nationwide measures, such as closures, shelter-in-place orders, and social distancing. Everyone has been impacted by the pandemic in varying degrees, including college students. College students may have been particularly challenged by these safety measures, having been forced to relocate from college campuses and continue classes online or in a hybrid format (Hagedorn et al., 2022). Closures and online-modalities displaced many college students, especially those in vulnerable populations, away from key academic and social support services, thus impacting academic performance, as well as mental and physical health (Birmingham et al., 2021; Hagedorn et al., 2022).

Across the country, social distancing and isolation exacerbated existing inequities, not only among college students but across the entire population. In particular, a rise in unemployment, an increased lack in food availability and accessibility, and closures of key social services impacted those suffering from hunger and food insecurity (FI). The exacerbated inequity of FI was reflected in an increased state in which individuals are unable to consistently access and/or consume adequate, nutritious food due to lack of resources (Feeding America, 2020). In the United States, the rate of FI in 2020 increased by 4.1%, with some 13 million additional Americans finding it difficult to access nutritious and consistent meals (Feeding America, 2020). While the FI ranged between 15% to 59.5% among college students prior to the pandemic, rates likely mirrored that of the nation since March 2020 with increases in FI (Abu & Oldewage-Theron, 2019; El Zein et al., 2019; Freudenberg et al., 2019; Hege et al., 2021; Payne-Sturges et al., 2017).

Despite imperative pressing need for aid demonstrated by the prevalence and increase in college FI, there are many barriers for this population to utilize federal and state safety net programs. In 2016, about a quarter of the 5.5 million low-income students at risk for FI were ineligible for the Supplemental Nutrition Assistance Program, the largest federal food assistance program in U.S. (United States Government Accountability Office, 2018). These service gaps may be detrimental as the intersectionality of FI, poor nutrition, psychosocial health, and academic performance found in college students prior to the pandemic may predict a decline in mental and physical health as a result of COVID-19 (Birmingham et al., 2021; Bruening et al., 2016; Hege et al., 2021; Payne-Sturges et al., 2017; Weaver et al., 2020).

Additionally, many marginalized communities face a disproportionate risk of FI. Notable disparities related to increased food insecure students include race, ethnicity, gender identity and sexuality; students of color, especially Latinx/Hispanic, African American, and indigenous students, experienced higher rates of FI than White students (Baker-Smith et al., 2020). This mirrors the higher rates of unemployment among Black and Hispanic/Latinx populations (Falk et al., 2021). Moreover, the higher unemployment rate among younger individuals, suggesting a greater risk of job loss among college students, was reflected as more than half of college students experienced a change in employment status during the pandemic (Falk et al., 2021; Owens et al., 2020).

Concerningly, the 2019 American College Health Association's National College Health Assessment of students from 98 U.S. postsecondary institutions found that the majority of students felt hopeless, overwhelmed, exhausted, lonely, sad or depressed within the past 12 months with college students attributing stress (34.2% of students), anxiety (27.8%), and/or depression (20.2%) as factors impacting academic performance (American College Health Association, 2019). Additionally, a longitudinal cohort study found that FI indirectly had a significant impact on students' grade point average due to high stress and poor psychosocial health (Raskind et al., 2019). Therefore, it is important to recognize the potential adverse effects of FI and poor psychosocial health, including stress on academic performance and success; these may have irreversible long-term impacts on students' career trajectories, socioeconomic status, health, and wellbeing.

Though the evidence of FI and poor psychosocial health, particularly perceived stress, affecting college students before the pandemic was prominent, the repercussions of the pandemic on these public health and social justice issues among this student population remain unclear. It is uncertain if the pandemic and its impact on the living situations, learning modalities, and employment opportunities for college students has or has not exacerbated these issues. Moreover, it is unclear what factor(s) influenced and may continue to influence college students' well-being, particularly stress, and FI as the pandemic continues. To begin understanding the experiences and feelings of students in relation to FI and stress during the pandemic, this cross-sectional survey research aims to examine the association between self-reported college FI and perceived stress among current and recently graduated college students from a land grant institution of higher education in the southeastern United States.

Methods

This cross-sectional quantitative study was conducted in 2020 at the University of Kentucky. Research questions of this study were to examine 1) changes in perceived stress from the period before the COVID-19 pandemic and the period since the pandemic, 2) differences in perceived stress scores by FI, living situation and employment status before and since the pandemic, and demographic variables, 3) relationship between FI status and variables, such as demographics, living situation and employment status before and since the pandemic, and food and/or financial assistance, 4) associations with FI, living situation, and perceive stress scores before and since the pandemic. Approval to conduct this research was obtained through the University of Kentucky Institutional Review Board (#45775) in May 2020.

Study Setting and Participants

A cross-sectional examination of college students at a land grant institution of higher education in the southeastern United States was completed during the initial spread of the COVID-19 pandemic in the United States. Eligible participants from a convenience sample included undergraduate, graduate, and recently graduated students, who were 18 years or older, fluent in English, and had internet access. Participants were recruited during the summer months in 2020 via a multi-departmental email list and were asked to complete an anonymous online Qualtrics survey. Those completing the survey were incentivized with a $10 e-gift card and were not eligible to complete the survey again.

Survey Measures

Survey items included demographics, FI screener (Hager, et al., 2010), and comparisons of various items before and since the pandemic including employment, perceived stress, food and/or financial assistance, living situations, and food budget. Participants were asked to share the following demographic information: biological sex (male or female), race and ethnicity (White or other, including African American; Asian; bi- or multi-racial; Hispanic or Latinx; further categorized as White or Other based on low diversity in the cohort), age (continuous in years), year in school (lower division with freshmen and sophomore students, upper division with juniors and seniors, graduate school, or recent graduate), since-COVID-19 living situations (with someone or alone), and receiving any food and/or financial assistance from federal, state, or community (yes or no). Recent graduates were defined as individuals who had graduated in May 2020.

To examine cross-sectional changes in perceived stress from the period before the COVID-19 pandemic (pre) and period since the pandemic (since), participants were asked to recall their self-reported perceived stress via a validated 10-item Perceived Stress Scale (PSS-10) (Cohen et al., 1983; Lee, 2012; Taylor, 2015). The validated PSS-10 measures participants' perceptions of psychological stress in their daily lives over a month's span (full scoring instructions can be found online (Perceived Stress Scale, n.d.). Specific to this study, we asked participants to recall stress levels prior to the COVID-19 pandemic and then compare those levels to current levels in the ongoing pandemic. PSS-10 questions are asked on a Likert item scale (0 = never, 1 = almost never, 2 = once in a while, 3 = often, 4 = very often). Four items in the PSS-10 tool are reverse coded (e.g., "how often have you been able to control irritations in your life?"), while the remaining six are non-reverse coded (e.g., "how often have you felt nervous and stressed?"). Scores for each item were summed for each participant on a scale from 0-40 (a score within 0-13 classifying low stress, 14-26 classifying moderate stress, and 27-40 classifying high stress).

FI was classified based on the 2-item screener from Hager et al. (2010) to give a binomial classification of food secure or food insecure. This tool is a validated, shortened version of the 6-item United States Department of Agriculture's Household Food Security Survey Module (Blumberg et al., 1999). The 2-item screener includes the following statements: "In the past year, the food that I bought just didn't last and I didn't have money to get more." And "In the past year, I was worried whether my food would run out before I got money to buy more.". Items were answered with the options of (1) never true, (2) sometimes true, and (3) often true. Affirmative answers (sometimes or often true) on either question are classified as food insecure. These data were used to categorize respondents dichotomously as Food Insecure or Food Secure.

Employment status pre- and since-COVID-19 (yes or no) were included in the survey. Employment status pre- and since-COVID-19 were used to assess associations with FI and PSS-10 stress scores pre- and since-COVID-19. Reasons for unemployment during the pandemic (unemployed prior to the pandemic, laid off or temporarily furloughed, not wanting to work during the pandemic, or other) were asked as a follow-up question for employment status since-COVID-19.

Data Analysis

Descriptive statistics are presented in means, frequencies or counts, and changes

from pre-COVID to since-COVID periods. Further analyses for PSS-10 were non-parametric analyses due to non-normality of the PSS-10 data. Mann-Whitney U test for independent samples was used to assess differences in non-parametric PSS-10 by FI status, employment status, living situation, and binomial demographics (sex and race) (see Table 2). Pearson Chi-square tests for independence were used to assess the relationship between FI status and selected demographic variables (see Table 1). Two multiple linear regression models were used to show the relationship of pre-PSS-10, FI, and living situation, while controlling for demographic variables (sex, age, year in school, and race/ethnicity). Multicollinearity was checked, and Cook's D was calculated for both multiple linear regression models. Cook's D outliers ($n = 3$) above 0.05 were excluded. Scaled parameter estimates were used to compare the relative effects of predictors measured on different scales. Effect sizes were calculated for each variable in the model. Significance level was set to < 0.05.

Strengths and Limitations

Limitations stem from the timeframe at which data collection occurred. Pre-COVID-19 data were self-reported after the COVID-19 outbreak had already occurred. Rather than reflecting on an experience, students were responding to their ongoing experience as COVID-19 continuously shifted the way we navigated everyday life. A snapshot assessment may not have captured accurate before- and since-pandemic data for useful comparison.

Additionally, an increase in student responses and the inclusion of exploratory questions on key factors of well-being such as predetermined factors would strengthen this study. Likewise, personal issues such as FI and stress may benefit from additional qualitative research approaches. This was also noted by Hagedorn et al. (2022). Focus groups, for example, would allow students to enhance the depth of their survey responses with more details and context. Sometimes questions about your personal health can be difficult to answer properly without the intentions of the author being clear. While the pandemic has impacted all of our lives, our experiences are all different and nuanced in a way that may be difficult to grasp and describe.

The strengths of this study lie in exploring the intersections of college FI and psychosocial health that are often overlooked in relation to COVID-19 among college students. This study shares important findings related to the assessment of college FI and perceived stress among college students during the first year of the COVID-19 pandemic; thus, adding to the limited literature on college student health during the

pandemic. Further, it is important to note that these data pertain specifically to college students, an often-overlooked population in many food insecurity and public health studies.

Findings

An online anonymous survey recruitment email was distributed to a cohort of 897 undergraduate students from lower division (first and second year) and upper division (third and fourth year and more), graduate students, and recently graduated students in the summer months of 2020. The survey response rate was 21.6% (*n* = 194). Of the sample, participants were predominantly female (*n* = 151; 77.8%), White (*n* = 144; 74.2%), 21 years old (21.8±3.1 years), and from upper division including junior and senior students (*n* = 89; 45.9%) (see Table 1). Of the total sample (*n* = 194), 31.3% were food insecure. Since the pandemic, all participants were removed from living on campus and 78% lived with someone, e.g., parents, grandparents, guardian, partner, or roommate.

Table 1

Pearson Chi-square Tests for Study Variables by FI Status

Variable		***n***	**Food Secure**	**Food Insecure**	***p-value***
Sex (*n*= 193)	*Male*	43	31 (23.5%)	12 (19.7%)	
	Female	150	101 (76.5%)	49 (80.3%)	.554
Race/Ethnicity (*n*= 193)	*White*	143	101 (76.5%)	42 (68.9%)	
	Other (including African American, Asian, biracial, Hispanic or Latinx)	50	31 (23.5%)	19 (31.1%)	.259
Year in school (*n*= 193)	*Lower division*	32	22 (16.7%)	10 (16.4%)	
	Upper division	88	60 (45.4%)	28 (45.9%)	
	Graduate school	35	24 (18.2%)	11 (18.0%)	
	Recent graduate	38	26 (19.7%)	12 (19.7%)	.999

Living situation pre-COVID-19 (*n*= 193)	*University housing*	68	49 (37.1%)	19 (31.1%)	
	Off-campus	125	83 (62.9%)	42 (68.9%)	.419
Living situation since-COVID-19 (*n*= 193)	*With someone*	151	108 (81.8%)	43 (70.5%)	
	Alone	42	24 (18.2%)	18 (29.5%)	.076
Food and/or financial assistance (*n*= 189)	*Did not receive*	134	100 (75.8%)	34 (59.6%)	
	Received	55	32 (24.2%)	23 (40.4%)	.015
Employment status pre-COVID-19 (*n*=189)	*Employed*	134	88 (66.7%)	46 (80.7%)	
	Not employed	55	44 (33.3%)	11 (19.3%)	.046
Employment status since-COVID-19 (*n*=194)	*Employed*	102	72 (54.1%)	30 (49.2%)	
	Not employed	92	61 (45.9%)	31 (50.8%)	.520

FI status was only reported for the time of data collection (summer 2020). Before the pandemic, food insecure participants were 2.06 times more likely to work for pay (p = .048, OR = 2.06, *95% CI* = 1.00 - 4.27). However, since the pandemic, there was no significant difference between FI and employment status (p = .52). Despite the pandemic, participants who worked pre-COVID-19 have a 3.49 higher likelihood of continuing to work (p <0.01, OR = 3.49, *95% CI* = 1.79 – 6.81). Of the participants in this study who indicated that they were not working for pay since COVID-19, 37.8% were laid off or temporarily furloughed.

Perceived stress PSS-10 scores in the present study were self-reported for pre- and since-COVID-19. Although PSS-10 scores for both pre- and since-COVID-19 fell within the moderate stress range (14-26), mean change between pre- and since-PSS-10 scores increased almost 5 points on the scale (M = 16.70, SD = 5.63 to M = 21.20, SD = 6.51) with higher pre-PSS-10 scores predicting higher since-PSS-10 scores (p < 0.01). There were significant differences in pre-PSS-10 scores between male and female, food secure and food insecure individuals, and those living on university housing and those living off-campus; however, the only significant difference in since-PSS-10 scores was between male and female (see Table 2).

Table 2.

Mann-Whitney U Test for Selected Study Variables by Pre- and Since-PSS-10 Scores

Variable		*n*	Pre-PSS-10 Scores (*M* ± *SD*)	*p*-value	Since-PSS-10 Scores (*M* ± *SD*)	*p*-value
Sex (*n*=186)	*Male*	40	14.88 ± 5.63		18.89 ± 7.12	
	Female	146	17.02 ± 5.36	.029	21.92 ± 6.01	.014
Race/Ethnicity (*n*=186)	*White*	139	16.27 ± 5.71		21.21 ± 6.36	
	Other (including African American, Asian, biracial, Hispanic or Latinx)	47	17.43 ± 4.65	.229	21.5 ± 6.39	.897
Food security status (*n*= 188)	*Food secure*	131	15.89 ± 5.74		20.78 ± 6.48	
	Food insecure	57	18.23 ± 4.39	.008	22.78 ± 5.93	.089
Employment status pre-COVID-19 (*n*= 192)	*Employed*	137	16.65 ± 5.84		21.56 ± 6.60	
	Not employed	55	16.42 ± 4.89	.521	20.47 ± 6.31	.255
Employment status since-COVID-19 (*n*= 191)	*Employed*	100	16.34 ± 6.13		20.66 ± 7.01	
	Not employed	91	16.90 ± 4.92	.904	21.93 ± 5.92	.358
Living situation pre-COVID-19 (*n*= 186)	*University housing*	66	14.59 ± 4.93		20.70 ± 6.06	
	Off-campus	120	17.64 ± 5.48	.000	21.60 ±6.52	.233
Living situation since-COVID-19 (*n*= 186)	*With someone*	146	16.19 ± 5.41		21.08 ± 6.49	
	Alone	40	17.9 ± 5.58	.099	22.03 ± 5.84	.411

Multiple linear regression (see Table 3; Model 1) was used to predict since-PSS-10 scores with pre-PSS-10 and FI as independent variables, controlling for influential demographics (sex, age, race/ethnicity, and year in school). Employment was not

included in the Model 1 or 2 because it was not significantly related to PSS-10 scores nor FI since the pandemic. In Model 1 ($F(8,180) = 8.28$, $p < 0.01$) , R^2 value of the model explained 27.8% of the variance in since-PSS-10 scores (adjusted R^2 = 24.4% variance). Among predictor variables, pre-PSS-10 ($p < 0.01$) was a significant predictor of since-PSS-10. As the sole influential variable contributing to since-PSS-10 scores, the effect size of pre-PSS-10 was large (partial $\eta^2 = 0.209$). FI alone (p=0.54) was not a significant predictor of since-PSS-10 (partial η^2 <.01).

A second multiple linear regression (Model 2) was also used to build on Model 1 to predict since-PSS-10 with pre-PSS-10, FI, living situation and their interaction terms, controlling for influential demographics again. Model 2 ($F(11,180) = 6.49$, $p < .01$) R^2 explained 29.7% of the variance (adjusted R^2 = 25.1%). Preliminary analyses conducted identified both pre-PSS-10*FI and pre-PSS-10*living situations were related and, therefore, were further used as interaction terms in this regression model. The multiple linear regression results were similar to those of the previous model (Table 3; Model 2); pre-COVID PSS-10 was a significant predictor of since-COVID PSS-10 with a medium effect size ($p < .01$; partial $\eta^2 = 0.046$). Likewise, the interaction term between pre-PSS-10 and FI was found to be a significant predictor ($p = 0.04$) of since-PSS-10. Of the two significant variables, pre-PSS-10 had a large effect size contributing to since-PSS-10 score (partial $\eta^2 = 0.80$), followed by a small effect from the interaction of pre-PSS-10 and FI (partial $\eta^2 = 0.03$). In other words, students classified as food insecure and having higher pre-PSS-10 scores were predicted to have higher since-PSS-10 scores.

Table 3.

Regression Models for Since-PSS-10 Scores

Variable	**Model 1**				**Model 2**			
	t	*β*	p	Effect size (partial η^2)	*t*	*β*	p	Effect size (partial η^2)
Sex [Female]	1.97	0.13	<.001	0.022	1.66	0.11	.098	0.016
Age	2.19	0.19	.030	0.027	2.17	0.19	.031	0.027
Race [Other/Biracial]	-0.74	-0.05	.461	0.003	-0.73	-0.05	.469	0.003
Class [Graduate]	-1.28	-0.13	.203	0.033	-0.65	-0.07	-.518	0.024
Class [Grad School**]**	-1.47	-0.17	.144	-	-1.46	-0.17	.146	-
Class [Lower]	2.42	0.28	.017	-	1.98	0.24	.050	-
Pre-COVID-19 PSS-10	6.75	0.46	<.001*	0.209	3.84	0.35	<.001*	0.080
FI (ref: Food Secure)	-0.61	-0.04	.541	0.002	-1.17	-0.08	.244	0.007
pre-COVID-19* FI (ref: Food Secure)			NE		2.10	0.18	.037*	0.025
Living (ref: Off-campus)			NE		-0.37	-0.03	.712	<.001
pre-COVID-19* Living (ref: Off-campus)			NE		0.22	0.02	.794	<.001

Model 1 and 2 were controlled for sex, age, race/ethnicity, and year in school (upper division is referent group). NE indicates not entered in the analysis.

Discussion

The current study sought to examine pre- and since-COVID-19 associations in relation to FI and perceived stress, as well as other factors, among college students and recent graduates from a land grant institution of higher education in the southeastern United States. Important study findings on college FI, employment and perceived stress were noted in discussion, adding to the growing literature on college student health and food insecurity during the COVID-19 pandemic. Based on the study findings, life skills (e.g., financial and cooking skills) and implications for practice and research were discussed in this section.

College Food Insecurity and Perceived Stress

Approximately 31.3% of participants experienced some levels of FI between the summer months of 2019 and 2020, spanning both periods of pre- and since-COVID-19. Before the pandemic, food insecure

participants were 2.06 times more likely to work for pay and had significantly higher pre-PSS-10 scores compared to food secure counterparts. Participants who worked pre-COVID-19 have a 3.49 greater chance of continuing to work despite the pandemic. Average perceived stress scores since-COVID-19 were 5 points higher than pre-PSS-10 scores, with higher pre-scores predicting higher since-scores. Perceived stress before COVID-19 was the most indicative of perceived stress since-COVID-19, followed by age and lower division student category. The intersection of FI and perceived stress was found to have a significant relationship pre-pandemic and was only further exacerbated by the onset of the pandemic.

While pre-PSS-10 scores were significantly different, since-PSS-10 scores were not significantly different among food secure groups which may partially be due to an increase in PSS-10 scores among both groups. This was seen as pre-PSS-10 scores of both food secure and insecure groups ranged in the lower levels of moderate stress level while since-PSS-10 scores for food insecure and secure students fall into the upper end of the moderate stress (Cohen et al., 1983). Although it is not statistically significant, mean perceived stress scores were higher among food insecure individuals in both pre- and since-COVID-19 periods compared to food secure participants. This finding of higher perceived stress in food insecure students is consistent with the results from a study conducted by El Zein et al. (2019). In addition, and tangentially related to stress, such a finding echoes results from Hagedorn et al. (2022) where newly and consistently food-insecure students reported higher levels of anxiety and depression than food-secure students.

Findings that highlight the exacerbation of poor mental health from the beginning of the pandemic to now are attributed to the relationship between psychosocial health, low income, and FI. A study, which utilized similar methods to this study, identified adults below the poverty line and screened them for depression, anxiety, and high-stress; the study found that one-third of all participants were positive for each category (Wolfson et al., 2021). This demonstrates how the pandemic may have led low-income situations to be exaggerated, leading to further instances of FI and poor psychosocial health among many Americans. Furthermore, the relationship between FI and health outcomes is exemplified by the over 200% increase in risk of depression and anxiety seen throughout the pandemic (Fang et al., 2021; Hagedorn et al., 2022). In other words, poor mental health early in the pandemic may have been indicative of the current increase of psychiatric disorders.

Similarly, an interview study found that the stress and anxiety in 71% of both food secure and insecure college participants at a large public university in the US increased due to the COVID-19 pandemic (Son et al., 2020). More specifically, the stressors identified by the majority of students included fear and stress about their own health and health of their loved ones, difficulty in concentrating on medial tasks, disruptions in sleeping patterns, decreased social interaction and increased concerns about academic performance (Son et al., 2020). Another study with similar findings indicated that during the first term impacted by COVID-19, students reported increased anxiety and depression symptoms and were more sedentary than previous academic terms (Huckins et al., 2020). It is important to note that the study from Huckins and colleagues (2020) was conducted within the semester in which the COVID-19 pandemic took place (beginning January 2020) and had the ability to investigate the progression of the pandemic; however, our study assessed the stress of students after the semester was completed beginning in June, 2020. In a study that looked particularly at college students in Appalachia, some 15% of the 2,000 participants found themselves newly food insecure with the onset of the pandemic (Hagedorn et al., 2022). This is particularly interesting because this trend may correlate to the increase in poor psychosocial health examined through our study.

Skills and Employment

The stress of these students may be impacted by factors, such as whether or not students have essential life skills, unemployment, and financial instability, which is often linked to greater stress and worsened psychological health (Gutter & Copur, 2011). For example, limited cooking skills may require some to purchase pre-made foods, which are sold at higher costs than individual ingredients, stretching their budget further and contributing to low or very low food security (Knol et al., 2019). In addition, poor budgeting skills and an increase in unemployment may exacerbate FI and foster additional psychological stress on all students regardless of food security status (Birmingham et al., 2021; Falk, et al., 2021; Gutter & Copur, 2011; Knol et al., 2019; Weaver et al., 2020). Therefore, programs supporting students on college campuses should consider promoting financial skills as part of their events, workshops, and activities. Though increasing the number of student employment opportunities would not be an easy feat, faculty and staff at higher education institutions should consider incorporating paid student opportunities as part of grants and funding requests to further support student

financially and academically which will likely promote student success and wellbeing.

Unlike the correlation between the emergence of COVID-19, FI, and stress, employment status and/or reason for unemployment among participants in this study was not significantly related to stress scores and FI, despite 37.8% of students not working for pay having been laid off or temporarily furloughed. In contrast, a study during the COVID-19 pandemic found that compared to students whose income was not impacted by the pandemic, the loss of employment made students 3.22 times (furloughed) to 5.73 times (lost part-time shift work) more likely to be food insecure (Owens et al., 2020; Hagedorn et al., 2022). With this being said, the current study's finding on a great number of students being furloughed shows a need for further investigation on the relation between access to healthy food and temporary unemployment.

Implications for Practice and Research

Building upon this pilot study data is vital to ensure that college student FI and psychosocial health is examined nationwide which can then contribute to the development of evidence-based practices for higher education institutions that equitably promote student success and well-being moving forward. Therefore, more rigorous, longitudinal studies with a larger, more nationally or regionally representative sample as well as matching baseline and follow-up measures on college student FI and psychosocial health are needed to better understand the complexity of those issues, barriers, challenges, and gaps for improvements related to student success and wellness.

Though college FI and stress are complex public health issues that undermine student success and well-being, many are not aware of these and there is little guidance on best practices surrounding these topics in higher education settings. Researchers of this study urge higher education institutions to recognize students' stress and food insecurity experiences as risk factors for student health which can affect student success and retention. Since perceived stress is subjective in nature and food insecurity tends to be a silent struggle that many students face, listening and responding to students on a timely manner would be critical. College food insecurity and stress initiatives should consider raising awareness of these issues and associated factors with strong, inclusive, equity-driven, and carefully crafted messaging that is supported by administration and a large, diverse body of campus members. It is important to publicize factors related to food insecurity through storytelling and approaches that humanizes students' challenges with food insecurity to ensure that students

experiencing food insecurity do not feel stigmatized, but rather feel supported. Food insecurity and stress reduction efforts that denormalize students' experiences and challenges with food access, affordability, student employment, funding, social pressures, and stress as well as improve critical life skills (e.g., time management, budgeting, and cooking) on campus are warranted in various settings (e.g. residence halls, classrooms, student organizations, and popular off-campus locations).

Emergency supplemental food assistance from campus food pantries is designed to serve as a temporary aid and food pantries alone would not be sustainable; therefore, long-term solutions to college FI and its related poor psychosocial health outcomes is warranted. To ensure such efforts are sustainable, effective, and student-centered, a multi-faceted interdisciplinary approach that targets multiple levels of Socio-ecological Model (e.g., peers and other organizations) with the involvement of dedicated faculty, staff, and experts from various fields as well as students themselves would be key in supporting this overlooked population of college students. It is critical to pull together resources across campus that are not just food- or wellness-related. For instance, academic departments, student organizations, advisors' network, and tutoring services also play a huge role in supporting college students. Nonetheless, in order to establish and sustain such multidimensional interdisciplinary efforts, sustained ongoing financial support and buy-in from higher education institution administrators is essential.

Conclusion

In all, although college students had high rates of stress and FI prior to the pandemic, COVID-19 has exacerbated these multidimensional issues in many ways. Further examination and targeted interventions are warranted as young adults have increasingly been burdened with higher rates of FI and mental health conditions. It is dire to recognize the relationship between FI and stress in the college student population as lifelong impacts on health and well-being may result. Ultimately, as Davis et al (2021) contended, we need to begin researching interventions: What works? What doesn't work? How do certain interventions work? Answers to these questions on effectiveness rely on more robust research following a return to "normalcy" in higher education. While there is uncertainty around the lasting effects of the pandemic on college students, the consideration of food security and perceived stress, key aspects in student well-being, is needed to create impactful since-COVID-19 campus services during the ongoing pandemic.

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