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Short communication

Food insecurity is adversely associated with psychological distress, anxiety and depression during the COVID-19 pandemic

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ABSTRACT

Early COVID-19 pandemic data showed a spike in both food insecurity and poor mental health. The purpose of this study was to examine the relationship between food insecurity and mental health outcomes nine months after the start of the COVID-19 pandemic. A national survey of adults 18 years and older was administered in December 2020 (N = 8,355). Multivariable logistic models and post-estimation margins commands were used to show the predicted probability of mental health outcomes (psychological distress, anxiety, and depression) by food security status. The majority of participants (68.5%) reported high/marginal food security, 15.5% had low food security, and 16.0% had very low food security. There was a strong dose response relationship between food insecurity and higher psychological distress, anxiety and depression. Fewer than one in five adults with high/marginal food security screened positive for all three mental health outcomes, while more than two in five adults with low food security screened positive for psychological distress (39.9%), depression (41.7%) and anxiety (41.3%). Among adults with very low food security, nearly half screened positive for psychological distress (47.7%), depression (48.1%) and anxiety (49.4%). Younger adults had higher prevalence of psychological distress compared to older adults regardless of food security status. Food insecure adults, particularly young adults, have higher rates of psychological distress, anxiety, and depression than their food secure counterparts. Facilitating opportunities to connect at risk populations with food assistance and affordable mental healthcare should be prioritized as the pandemic continues and beyond.

1. Introduction

Food insecurity, limited or uncertain access to sufficient, nutritious food for an active, healthy life, has increased in the United States (U.S.) during the COVID-19 pandemic due to severe economic disruption (Wolfson and Leung, 2020a; The Impact of the Coronavirus on Food Insecurity, 2020). Food insecurity continues to disproportionately impact lower-income households during the pandemic, (Dubowitz et al., 2021; Siddiqi et al., 2021) and is associated with numerous adverse short- and long-term outcomes including poorer mental health. (Jones, 2017; Leung et al., 2015; Weinberger et al., 2018; Martin et al., 2016) During the COVID-19 pandemic, existing race/ethnic and socio-economic-based health disparities have been exacerbated including those associated with food insecurity (Wolfson et al., 2021). For many, particularly lower-income Americans already at higher risk for food insecurity and poorer mental health, stay-at-home orders, social isolation, economic uncertainty, and restrictions on healthcare access have worsened existing mental health conditions such as psychological distress, depression, and anxiety (Wolfson and Leung, 2020a; Wolfson et al., 2021; Wolfson and Leung, 2020b).

Evidence from early in the pandemic showed that U.S. adults reported higher rates of psychological distress symptoms, and nationally representative survey data found that food insecure adults were more likely to screen positively for depression, anxiety, and stress (Wolfson et al., 2021; KFF Health Tracking Poll-Early, 2020). Previous evidence has also shown that mental health among younger adults has been particularly strained during the pandemic (McGinty et al., 2020). Given these early signals, and uncertainty about whether they would persist as the pandemic continued, we sought to examine the relationship between food insecurity and mental health outcomes, including psychological distress, anxiety, and depression, in a large, nationally representative sample of U.S. adults in December 2020, nine months after the start of

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the COVID-19 pandemic.

2. Methods

2.1. Study design

The study design and survey tool are described in more detail elsewhere (Gibson et al., 2021). Briefly, an online survey was administered to a representative sample of U.S. adults (≥18 years old) matched based on age, race, gender, education, income, and Census region using a random sample from Dynata's database in December 15–23, 2020. Of the 10,107 invited to participate 8,481 completed consent via the online platform, and completed the survey (completion rate of 83.6%). Participants were excluded from the analyses if they were missing food security (N = 27) or mental health outcome data (N = 66), or selected 'other' for gender (N = 33) resulting in a final analytic sample of 8,355. This study was approved by the Institutional Review Board (IRB No. 12143) at the Johns Hopkins Bloomberg School of Public Health.

2.2. Measures

2.2.1. Psychological distress

Psychological distress was measured using the Patient Health Questionnaire-4 (PHQ-4) (Löwe et al., 2010). The PHQ-4 includes four questions about frequency of experiencing psychological distress in the past two weeks. Responses are anchored by "not at all" and "nearly every day." Total scores range from 0 to 12 and are categorized into four levels of severity of psychological stress: none, mild, moderate, and severe. A binary measure was created where psychological distress total score ≤ 5 (none or mild) was coded as "0," and a total score ≥ 6 (moderate or severe) was coded as "1" (Löwe et al., 2010).

2.2.2. Anxiety and depression

Anxiety and depression are measured as subscales of the PHQ-4. Of the four questions, two measure anxiety and two measure depression. For each subscale, a score of ≥ 3 was considered to be positive. A binary measure was created where a subscale score of ≤ 3 was coded as "0," and a subscale score of ≥ 3 was coded as "1" (Löwe et al., 2010).

2.2.3. Food security

Household food security was assessed over the last 30 days using the Six-Item US Household Food Security Screener Module Short Form (U.S. Household Food Security Survey Module, 2012). Total food security score was measured by summing all affirmative responses and categorized by high/marginal (0–1 points), low (2–4 points), and very low (5–6 points) (U.S. Household Food Security Survey Module, 2012).

2.2.4. Demographics

Sociodemographic covariates included sex, race/ethnicity, age, education level, household income, employment status, job loss or loss of >50% of household income due to COVID-19, state of residence, and health insurance status.

3. Statistical analysis

All analyses used survey weights to produce nationally representative estimates (**See Appendix 1**). Cross-tabulations and chi-squared tests were used to describe the sample by food security status. Logistic regression models, adjusted for the covariates described above, examined associations between food security status and mental health outcomes: psychological distress, anxiety, and depression. Post-estimation margin commands were used to show the predicted probability of psychological distress, anxiety, and depression by food security status. Interaction models between food security status and age were also explored. Significance was considered at $p < 0.05$ and all tests were two-sided. Analyses were conducted using Stata, Version 16 (StataCorp., 2019).

4. Results

Participant demographics overall and by food security status are summarized in Table 1. The majority of participants (68.5%) reported high/marginal food security, 15.5% had low food security, and 16.0% had very low food security. Unadjusted rates of psychological distress were higher among food secure adults (high/marginal (37.8%)) and adults with very low food security (34.1%) with the lowest rates of psychological distress among adults with low food security status (28.1%), $p < 0.001$. A similar trend was observed for depression ($p < 0.001$) and anxiety ($p < 0.001$). Food insecure individuals (low or very low food security) were more likely to be Non-Hispanic Black or Hispanic, younger, less educated, lower-income, uninsured, and have lost their job or < 50% of income during the pandemic (all p's < 0.001).

Fully adjusted logistic regression models showed a positive dose response relationship between food insecurity and psychological distress, depression, and anxiety (Supplemental Fig. 1, all p-values < 0.001 (ORs available in Supplemental Table 1)). While fewer than 1 in 5 adults with high/marginal food security screened positive for each of the three outcomes, more than 2 in 5 adults with low food security had a higher probability of experiencing psychological distress (39.9%), depression (41.7%) and anxiety (41.3%), and among adults with very low food security nearly half had a higher probability of experiencing psychological distress (47.7%), depression (48.1%) and anxiety (49.4%).

Interaction models showed that younger adults had higher predicted prevalence of psychological distress compared to older adults regardless of food security status (Fig. 1). For example, more than one-third (35.7%) of food secure individuals ages 18–34 experienced psychological distress. This was significantly higher than rates of psychological distress among food secure adults in all other age groups; there was a clear trend of psychological distress declining steadily with increasing age with 11.0% of 55–64 year-olds and 6.4% of individuals 65 years old and older experiencing psychological distress. More than 50% of adults aged 18–24 with very low food security screened positive for psychological distress with the highest prevalence of all age and food security groups among 25–34 year-olds with very low food security (63.4%). Among all age groups, food insecure (both low and very low food security status) adults had significantly higher rates of psychological distress compared to food secure adults of the same age (all p's < 0.05). These trends were similar for anxiety, and depression, results not shown.

5. Discussion

In this study we examined the association between food security status and mental health outcomes in a large, nationally representative sample of U.S. adults nine months after the COVID-19 pandemic began (Notice on the Continuation of the National Emergency Concerning the Coronavirus Disease, 2019). Consistent with prior evidence from early in the pandemic (Wolfson et al., 2021; KFF Health Tracking Poll-Early, 2020), we find that food insecurity is associated with higher prevalence of psychological distress, depression, and anxiety, particularly among younger Americans, even after adjustment for sociodemographic covariates. This study demonstrates that food insecurity during the pandemic continues to be negatively associated with mental health (Wolfson et al., 2021; Wolfson and Leung, 2020b; KFF Health Tracking Poll-Early, 2020; Riehm et al., 2021), and supports urgent investment in addressing both food insecurity and mental health, particularly for young adults.

Policies and programs to support Americans struggling to afford food have been implemented to address the unprecedented need during the pandemic (American Workers, 2020; American Rescue Plan, 2021). For example, Supplemental Nutrition Assistance Program (SNAP) and the Special Supplemental Nutrition Program for Women, Infants, and

Table 1
Participant Characteristics from a Survey of U.S. Adults Nine Months After the Onset of COVID-19.

	Overall No. (%)	High/Marginal Food Security	Low Food Security	Very Low Food Security	P-Value[a]
		No. (%)	No. (%)	No. (%)	
Total	8,355	5630 (68.5)	1357 (15.5)	1368 (16.0)	
Sex					0.153
Male	4133 (48.5)	2900 (48.0)	613 (51.0)	620 (48.5)	
Female	4222 (51.5)	2730 (52.0)	744 (49.0)	748 (51.7)	
Race					**<0.001****
Non-Hispanic White	5114 (63.2)	3791 (68.4)	598 (47.7)	725 (55.5)	
Non-Hispanic Black	1109 (11.8)	576 (9.8)	303 (18.2)	230 (14.4)	
Hispanic	1434 (16.5)	779 (13.4)	322 (23.1)	333 (23.4)	
Other	698 (8.5)	484 (8.4)	134 (10.9)	80 (6.7)	
Age					**<0.001****
18–24	1110 (11.7)	488 (7.7)	372 (24.2)	250 (16.6)	
25–34	1327 (18.1)	615 (12.4)	351 (29.8)	361 (30.8)	
35–44	1478 (16.4)	824 (13.7)	289 (20.0)	365 (24.5)	
45–54	1563 (16.1)	1121 (16.6)	200 (13.9)	242 (16.0)	
55–64	1384 (16.4)	1157 (20.1)	106 (8.1)	121 (9.0)	
65+	1493 (21.3)	1425 (29.5)	39 (4.0)	29 (3.1)	
Education					**<0.001****
High school or less	1648 (19.9)	900 (16.5)	360 (26.2)	388 (28.7)	
Associates Degree	901 (10.7)	562 (9.8)	190 (14.0)	149 (11.1)	
Some College	1654 (20.1)	1062 (19.3)	264 (19.2)	328 (24.3)	
Bachelor's Degree	2411 (29.1)	1841 (32.4)	307 (23.6)	263 (20.2)	
Graduate Degree	1741 (20.2)	1265 (22.0)	236 (16.9)	240 (15.7)	
Employment					**<0.001****
Full Time	3800 (43.6)	2488 (41.5)	640 (47.5)	672 (48.6)	
Part Time	971 (11.3)	557 (9.7)	231 (16.7)	183 (13.2)	
Unemployed	639 (7.6)	295 (5.1)	158 (12.0)	186 (14.1)	
Out of Labor Force	2944 (37.5)	2290 (43.6)	328 (23.8)	326 (24.1)	
Job Loss					**<0.001****
Yes	1772 (20.9)	538 (9.4)	433 (33.1)	801 (58.7)	
No	6466 (77.8)	5028 (89.6)	888 (64.3)	550 (40.3)	
Refused	117 (1.3)	64 (1.1)	36 (2.6)	17 (1.1)	
Income					**<0.001****
<$20,000	1250 (14.7)	510 (9.3)	332 (23.6)	408 (29.7)	
$20,000–39,999	1366 (16.5)	713 (13.1)	327 (23.6)	326 (24.5)	
$40,000–69,999	1639 (20.4)	1212 (22.3)	221 (17.2)	206 (15.4)	
$70,000–99,999	1340 (16.3)	1024 (18.0)	184 (14.9)	132 (10.1)	
$100,000–149,999	1334 (16.0)	1032 (18.3)	144 (10.3)	158 (11.5)	
$150,000 or more	989 (11.0)	772 (12.7)	110 (7.7)	107 (6.7)	
Not reported	436 (5.1)	366 (6.4)	39 (2.6)	31 (2.2)	
Region					**0.035***
Midwest	1744 (21.4)	1203 (21.7)	255 (19.8)	286 (21.4)	
Northeast	1513 (18.6)	1080 (19.4)	220 (16.6)	213 (16.7)	
South	3132 (36.8)	2027 (35.8)	559 (39.7)	546 (38.1)	
West	1966 (23.3)	1320 (23.1)	323 (23.9)	323 (23.8)	
Health Insurance Coverage					**<0.001****
Yes	7084 (85.3)	5083 (90.7)	915 (67.6.3)	1086 (79.3)	
No	1012 (11.8)	424 (7.3)	357 (26.4)	231 (17.0)	
Don't Know/Refused	259 (3.1)	123 (2.2)	85 (6.3)	51 (3.7)	
Mental Health[b]					
Psychological Distress	2332 (27.1)	864 (37.8)	674 (28.1)	794 (34.1)	**<0.001****
Depression	2407 (27.7)	888 (37.6)	707 (28.7)	812 (33.7)	**<0.001****
Anxiety	2420 (28.3)	928 (39.2)	681 (27.4)	811 (33.4)	**<0.001****

Boldface indicates statistical significance (*$p < 0.05$, **$p < 0.001$)

[a] Percentages represent column percentages (except for the 'Total' row which reports row percentages). P-values are derived from chi-squared tests.

[b] Counts and percentages represent those who screened positive for psychological distress, depression, and/or anxiety.

Children (WIC) benefits were expanded, benefit levels have temporarily increased through September 2021, and greater administrative flexibilities have helped access these programs during the pandemic. Unemployment Insurance benefits also increased and stimulus checks were disseminated April and December 2020 to help subsidize food costs and other basic needs during the economic crisis caused by the pandemic. In addition, flexibilities to connect Americans with needed mental health care, particularly via telehealth and relaxation of state licensing policies allowing for provision of care across state lines, have also been implemented to improve health care access (American Workers, 2020).

However, the current findings indicate that even after these policies were implemented food insecurity remains high and is associated with stark disparities in mental health outcomes, demonstrating that more support is needed. Younger adults, even those who were food secure, had the highest rates of psychological distress, depression, and anxiety. This unexpected finding could be due to younger people facing new

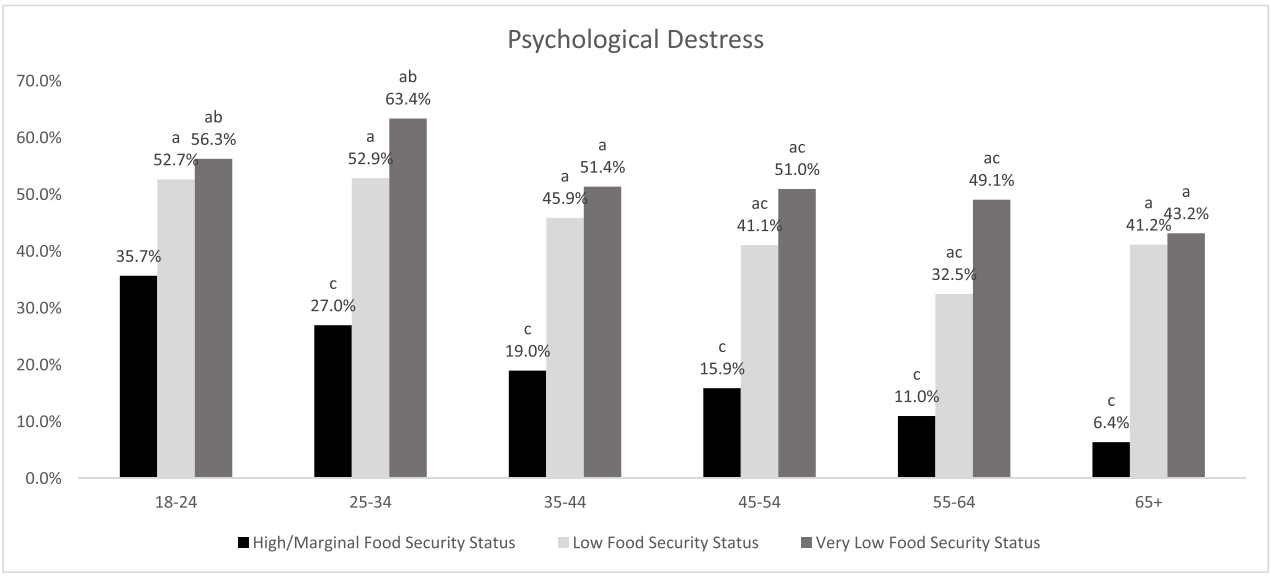

Fig. 1. Predicted Prevalence of Psychological Distress within Food Security Categories by Age Group in a Sample of U.S. Adults from a National Cross-Sectional Survey Nine Months After the Onset of COVID-19. [a]Prevalence of psychological distress significantly different from high/marginal food security within age group at $p < 0.05$. [b]Prevalence of psychological distress significantly different from low food security status within age group at $p < 0.05$. [c]Prevalence of psychological distress significantly different from 18 to 24-year-olds within food security status at $p < 0.05$.

challenges related to the pandemic, and lacking support systems and established resources to buffer the financial impact of the pandemic. This underscores the urgency of connecting young, food insecure adults and other populations at high risk for adverse mental health outcomes with affordable mental healthcare especially given that younger adults are more likely to lack consistent health insurance coverage and thus incur more out-of-pocket expenses (American Rescue Plan, 2021), a task that is complicated by our findings that high psychological distress was associated with job loss, and low-income.

Importantly, these findings demonstrate how disparities in food security and mental health have persisted throughout the pandemic. Nine months into the pandemic, we continue to see high rates of both food insecurity and mental health, even as the economy begins to recover and businesses begin to reopen. This raises the question of how long the temporary policies currently in place mentioned above should continue to be in effect. It may be beneficial to continue such policies to ensure adequate food access and health care along with focusing on creating affordable health care plans that cover mental health care, especially for younger adults. Digital strategies in particular may be effective to reach a younger population such as telehealth and mhealth for healthcare delivery and applications like Link2Feed (Link2Feed, 2020) and Feeding America's food bank locator (Find Your Local Food Bank, 2021) to address food security. Of note, data for this study was collected just after the first COVID-19 vaccine was approved in the US. Future studies might consider how vaccine access influenced mental health outcomes.

This study has several limitations. First, this was an online survey that excluded those without internet access. The survey was also conducted in English only so did not capture non-English speakers which limits generalizability to those populations. In addition, though designed to be nationally representative, our sample differs in some respects from the overall adult population in the US; notably our sample is slightly younger and more highly educated. Finally, this study was cross-sectional so causal relationships cannot be established.

6. Conclusion

This nationally representative survey of U.S. adults found high psychological distress among younger adults and a strong, dose response relationship between food security status and mental health among adults of all ages nine-months into the COVID-19 pandemic. Opportunities to connect food insecure and younger adults with needed mental healthcare should be prioritized as the pandemic continues and beyond.

CRediT authorship contribution statement

Samantha M. Sundermeir: Methodology, Formal analysis, Writing - original draft, Visualization. **Julia A. Wolfson:** Conceptualization, Methodology, Writing - review & editing, Visualization, Supervision. **Jackie Bertoldo:** Methodology, Writing - review & editing, Visualization. **Dustin G. Gibson:** Conceptualization, Methodology, Writing - review & editing, Funding acquisition. **Smisha Agarwal:** Conceptualization, Methodology, Writing - review & editing, Funding acquisition. **Alain B. Labrique:** . **:** Conceptualization, Methodology, Writing - review & editing, Project administration.

Declaration of Competing Interest

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

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.pmedr.2021.101547.

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