HHS Public Access

Author manuscript

Am J Prev Med. Author manuscript; available in PMC 2022 May 04.

Published in final edited form as:

Am J Prev Med. 2021 April ; 60(4): 453–461. doi:10.1016/j.amepre.2020.12.004.

Food Insufficiency and Mental Health in the U.S. During the COVID-19 Pandemic

Jason M. Nagata, MD, MSc[1], **Kyle T. Ganson, PhD, MSW**[2], **Henry J. Whittle, MBBS, MS**[3], **Jonathan Chu, BA**[1], **Orlando O. Harris, PhD, RN, MPH**[4], **Alexander C. Tsai, MD, PhD**[5,6,7], **Sheri D. Weiser, MD, MPH**[8]

[1]Division of Adolescent & Young Adult Medicine, Department of Pediatrics, University of California San Francisco, San Francisco, California;

[2]Factor-Inwentash Faculty of Social Work, University of Toronto, Toronto, Ontario, Canada;

[3]Division of Psychiatry, University College London, London, United Kingdom;

[4]Department of Community Health Systems, School of Nursing, University of California San Francisco, San Francisco, California;

[5]Center for Global Health, Massachusetts General Hospital, Boston, Massachusetts;

[6]Mongan Institute, Massachusetts General Hospital, Boston, Massachusetts;

[7]Harvard Medical School, Boston, Massachusetts;

[8]Division of HIV, Infectious Diseases & Global Medicine, School of Medicine, University of California San Francisco, San Francisco, California

Abstract

Introduction: During the COVID-19 pandemic, the rates of food insecurity and mental illness have been projected to increase in the U.S. owing to significant social and economic disruption. This study aims to estimate the prevalence of food insufficiency (often the most extreme form of food insecurity), the correlates of food insufficiency, and the associations between food insufficiency and symptoms of poor mental health in the U.S. during the COVID-19 pandemic.

Methods: Cross-sectional data from 63,674 participants of the U.S. Census Household Pulse Survey were collected and analyzed in 2020. Multiple Poisson regression models were used to estimate associations with food insufficiency.

Results: Food insufficiency rose from 8.1% to 10.0% from March to June 2020. Factors associated with food insufficiency included lower age, Black/African American or Latinx race/ethnicity, being unmarried, larger household size, recent employment loss, income below the federal poverty line, and lower education (all $p<0.001$). Food insufficiency was independently associated with all symptoms of poor mental health, adjusting for socioeconomic and demographic factors (adjusted RRs ranged from 1.16 to 1.42, all $p<0.001$). The association between food

Address correspondence to: Jason M. Nagata, MD, MSc, Division of Adolescent & Young Adult Medicine, Department of Pediatrics, University of California San Francisco, 550 16th Street, 4th Floor, Box 0110, San Francisco CA 94158. jasonmnagata@gmail.com.

insufficiency and poor mental health was attenuated among people who received free groceries or meals.

Conclusions: Food insufficiency has increased during the COVID-19 pandemic and affects vulnerable populations, placing individuals at higher risk for symptoms of poor mental health. Particularly in the current crisis, clinicians should regularly screen patients for food insufficiency and mental health outcomes as well as provide support in accessing appropriate resources.

INTRODUCTION

Food insecurity is the inability to afford or access nutritionally adequate and safe foods for an active, healthy lifestyle.[1] Food security is a fundamental, basic need, and serves as a global indicator of a country's overall security.[2] Food insufficiency, often the most extreme form of food insecurity, generally describes whether households have enough food for their families to eat.[3] With the onset of the unprecedented coronavirus disease 2019 (COVID-19) pandemic, levels of food insecurity and food insufficiency were projected to dramatically increase in the U.S.[4] There are several reasons for this. The social and economic consequences of the pandemic, including stay-at-home orders, changes in consumer demand, school closures, and rising unemployment, have the potential to exacerbate food insufficiency where individuals find themselves unable to safely purchase or afford food for their families.[5] Before the pandemic, nearly 35 million children in the U.S. received free meals at school daily, with a higher proportion of children of color receiving free meals.[6–8] Disparities in food insecurity are linked to food deserts and food apartheid, where the lack of availability of healthy foods disproportionately affects communities of color.[9] In addition, food system and supply chain disruptions during COVID-19 owing to border closures, essential worker illnesses, and other factors can cause food shortages[10] and insufficiency, reduce food quality, and inflate food prices.[5,11] Finally, social isolation due to fear of viral exposure, social distancing policies, or stigma from infection can undermine help seeking from social networks, further exacerbating food insufficiency.

Worsening food insecurity can in turn worsen health in the context of a COVID-19 illness. Specifically, food insecurity may contribute to weakened host defenses and immunologic decline owing to micronutrient deficiencies.[12,13] Food insecurity is associated with diets high in low-cost, energy-dense packaged foods but low in fruits and vegetables, which may lead to chronic medical conditions such as diabetes and hypertension, both of which are known to be associated with a higher risk for severe COVID-19 illness.[12,14–17]

The progression of the COVID-19 pandemic has also led to poor mental health, including anxiety and depression.[18–20] Before the COVID-19 pandemic, social isolation was already increasing,[21] and the opioid epidemic was a national crisis.[22] Food insecurity has the potential to further exacerbate this mental health crisis because it alone is an important contributor to poor mental health. The association between food insecurity and depressive symptoms is especially well studied, with longitudinal studies in the U.S. specifically suggesting a bidirectional relationship.[23] Food insecurity may lead to poor mental health through chronic stress, stigmatization, and perceived powerlessness.[24,25] Conversely, people experiencing poor mental health symptoms may be less able to work, generate income,

or manage financial resources, which could exacerbate food insecurity.[24,26] This finding has been shown in diverse geographic contexts and across a wide range of mental health outcomes.[24,27–30] However, previous studies examining the association between food insecurity and mental health have not examined individual symptoms (in particular worrying and little interest, in addition to anxiety and depression).[31] Furthermore, there is a paucity of data on how receipt of food aid may modify the association between food insecurity and mental health.

There is an urgent need to understand the factors associated with food insecurity/insufficiency during the pandemic at the national level because the results of these studies could inform policy and resource allocation for federal pandemic relief legislation currently being discussed. Furthermore, understanding the magnitude of the association between food insecurity/insufficiency and poor mental health specifically during the COVID-19 pandemic and how these associations may be modified among people who receive food aid can further inform screening guidance, policy, and resource allocation for food aid and mental health services during the pandemic. Therefore, the objectives of this study are to use national Census data in the U.S. during the COVID-19 pandemic to estimate (1) the prevalence of food insufficiency, (2) factors associated with food insufficiency, (3) the association between food insufficiency and symptoms of poor mental health, and (4) how receipt of free food may modify the association between food insufficiency and symptoms of poor mental health.

METHODS

This study analyzed data from June 11 to June 16, 2020 of the weekly, cross-sectional Household Pulse Survey (HPS) (N=63,674), which is conducted by the U.S. Census Bureau. HPS was developed in collaboration with 5 federal agencies: the U.S. Department of Agriculture Economic Research Service, Bureau of Labor Statistics, National Center for Health Statistics, National Center for Education Statistics, and Department of Housing and Urban Development. HPS aims to survey U.S. adults on the social and economic impacts of the COVID-19 pandemic. The HPS survey was reviewed by the Center for Behavioral Science Methods as well as the Demographic Directorate and subject experts from the 5 partner federal agencies.

To gather the sample, HPS used the Census Bureau's Master Address File as the primary sampling frame to collect responses from a large sample that would be sufficient for the anticipated low response rates. Sampled households were contacted by e-mail or cell phone text messaging. The online platform Qualtrics was used as the primary data collection method. Once a complete interview was obtained from a household, that household remained in the sample for up to 2 additional weekly interviewing periods. These methods increased efficacy, reduced costs, and provided timely responses despite the anticipated relatively low response rates compared with those of the in-person or mail surveys traditionally conducted by the Census Bureau. Sample weights, based on measures such as the demographic distribution of the survey respondents compared with benchmarks, were produced to address the potential nonresponse bias. Additional details regarding the study and data, which are publicly available and deidentified, may be found on the

Census Bureau website.[32] Research involving unidentifiable/deidentified information that is publicly available is not considered human subjects research by the NIH definition because investigators cannot ascertain the identities of the individuals in the data.[33] In these cases, IRB review is not required. Measures are described in Table 1.

Statistical Analysis

Unadjusted differences were calculated using independent samples *t*-tests (continuous variables) or Pearson's chi-square tests (categorical variables). Multiple Poisson regression analyses[34] with robust estimates of variance estimated the associations between demographic/socioeconomic factors and food insufficiency. Multiple Poisson regression models with robust estimates of variance estimated the associations between food insufficiency and mental health symptoms (nervous, anxious, or on edge; not being able to stop or control worrying; little interest or pleasure in doing things; feeling down, depressed, or hopeless) in the past 7 days, adjusting for demographic and socioeconomic covariates. Poisson regression was used for the mental health symptom outcomes because logistic regression only yields valid approximations of RR when the outcome is rare.[35] As shown by Zou,[36] the incidence RRs estimated using Poisson regression models can be interpreted straightforwardly as RRRs. Interactions between food insufficiency and receipt of free groceries/meals were statistically significant ($p<0.05$); thus, stratified models by receipt of free groceries/meals (yes/no) were presented additionally. Nonresponse sample weighing was applied. Analyses were conducted using Stata, version 15.1, in 2020.

RESULTS

Demographic characteristics of the participants included in the sample are presented in Table 2 by food sufficiency status. Overall, the prevalence of food insufficiency increased from 8.1% to 10.0% from March to June 2020 in the U.S. Nearly one tenth (9.4%) of households received free groceries or meals in June 2020, most often from a school program (4.1%); food pantry or food bank (2.9%); or family, friends, or neighbors (2.5%). Among participants reporting food insufficiency, 76.5% experienced a recent employment loss in the past 7 days, 54.4% had income below the federal poverty level, and 93.8% reported ≥1 mental health symptom, including feeling anxious, worrying, having little interest, or being depressed.

In unadjusted comparisons, younger age, Black/African American race, multiple races, Hispanic/Latinx ethnicity, being unmarried, greater number of children and adults in the household, employment loss in the past 7 days, reporting income below the federal poverty line, and low education were associated with food insufficiency (Tables 2 and 3).

The estimated associations between food insufficiency and mental health symptoms, including anxiety, worry, anhedonia, and depression, are presented in Table 4. Participants experiencing food insufficiency had a greater risk of experiencing any symptom of poor mental health (adjusted RR [ARR]=1.16, 95% CI=1.11, 1.21), feeling anxious (ARR=1.26, 95% CI=1.21, 1.32), worrying (ARR=1.39, 95% CI=1.33, 1.45), feeling little interest (ARR=1.35, 95% CI=1.28, 1.43), and feeling depressed (ARR=1.42, 95% CI=1.35, 1.50).

The associations between food insufficiency and poor mental health symptoms were attenuated among people who received free groceries or meals.

DISCUSSION

Overall, the prevalence of food insufficiency, often the most extreme form of food insecurity, increased from 8.1% to 10.0% from March to June 2020 during the COVID-19 pandemic, with 9.4% of people receiving free groceries or meals. The correlates of food insufficiency included lower age, Black/African American race, multiple races, Latinx ethnicity, being unmarried, greater number of children and adults in the household, having recent employment loss, reporting income below the federal poverty line, and having lower education. Food insufficiency was associated with symptoms of poor mental health independent of these other socioeconomic and demographic factors, and this association was attenuated among people who received free groceries or meals.

The correlates of food insufficiency identified in this study likely represent a complex and multifaceted network of vulnerabilities among affected individuals. Food insecurity is closely interlinked with other forms of economic insecurity, such as insecurities in employment and income, for which racial and ethnic minorities are at an elevated risk.[37] The intersection between these material need insecurities can shed light on how the current COVID-19 pandemic has sharply intensified racial, health, and socioeconomic disparities among marginalized groups in the U.S.[38] For example, although non-White racial and ethnic minorities are disproportionately represented as essential workers (such as in the public transportation, health care, public safety, retail, warehouse, and agricultural labor sectors), during the COVID-19 pandemic, these jobs carry a high risk of occupational exposure to COVID-19.[39] Many of these individuals also work for hourly wages on precarious contractual arrangements without the option of working from home.[40] Not only could this constraint in itself make purchasing enough food difficult, but limited resources may equally be required for other more important or time-critical needs, such as paying rent, household utilities, health insurance premiums, or hospital bills, further exacerbating food insecurity/insufficiency.[37,41] In addition, COVID-19 exacerbates conditions that exist because of institutional and structural racism.[38,42] The higher prevalence of food insufficiency among racial/ethnic minorities could also lead to worse disease control and further worsen morbidity and mortality from COVID-19. Future research can examine racial/ethnic disparities in other forms of economic insecurities, such as in employment, income, and education insecurities, both before and during the COVID-19 pandemic.

Furthermore, according to the most recent employment data from the Bureau of Labor Statistics of the U.S. Department of Labor, Blacks (15.4%) and Hispanics (14.5%) account for a higher proportion of the population affected by the current rise in unemployment rate than their White counterparts (11.2%).[43] In addition, Black (20.8%) and Latinx (17.6%) communities have higher rates of poverty than Whites (8.1%) or the general population (11.8%).[44,45] These data corroborate the findings that race (Black and Latinx), reporting a low income, and having recent employment loss are all factors associated with food insufficiency. Finally, the COVID-19 pandemic has further exacerbated social and structural inequalities among Black, Latinx, and other low-income families in the U.S. by limiting

their access to social support services, such as the Supplemental Nutrition Assistant Program (SNAP) and Special Supplemental Nutrition Program for Women, Infants, and Children (WIC). These 2 programs are especially relevant because they provide needed food assistance to families living below the federal poverty level; they are designed to specifically protect against the food insufficiency observed in this study.[38]

Food insufficiency has known links with poor mental health that likely operate in a bidirectional relationship.[23] A depressed mood in particular can manifest as having low energy, decreased motivation, feelings of hopelessness, pessimism around the future, and poor concentration. All of these features may erode the capacity of an individual at risk for food insufficiency to navigate the eclectic mixture of public and private provision that constitutes the U.S. social safety net.[46] For those experiencing insecure or hourly wage work, a depressed mood and anxiety may also interfere with work capabilities and lead to lost income, again elevating the risk of food insufficiency. These potential mechanisms position poor mental health as a risk factor for food insufficiency and may explain some of the associations seen in this study, especially in the context of concerns around rising depression and anxiety amidst the pandemic.[18]

Equally, food insecurity and food insufficiency are known risk factors for poor mental health, including depression and anxiety.[23,24,28] In addition to feelings, such as hunger, exhaustion, worry, and frustration, that may directly give rise to depressive and anxious symptoms, the experience of food insecurity in the U.S. is often characterized by salient stigma, shame, and self-blame.[46,47] Qualitative research has shown that these latter aspects of food insecurity often reflect a perceived failure of self-sufficiency and personal success among affected individuals, which is particularly damaging amid the individualist interpretations of wealth and achievement that are culturally prominent in the U.S.[46] In this respect, food insecurity is a profoundly relational experience that derives much of its potency from the context in which it occurs. Experiencing acute food insufficiency at such a significant and uncertain macro-contextual juncture as the COVID-19 pandemic may accentuate an individual's sense of vulnerability, isolation, and despair.[48] At the same time, personal or community resources that help to mitigate the mental health impacts of food insecurity may be disrupted during the pandemic, and some individuals may be newly exposed to food insecurity. In this respect, it is plausible that food insufficiency may drive the poor mental health outcomes seen in this study and significantly contribute to rising rates of depression and anxiety during the pandemic. This is especially concerning because previous studies have also suggested that food insufficiency may limit engagement with mental health services, worsen treatment adherence, and consequently elevate the risk for psychiatric emergency care and hospitalization, thus posing further challenges at an already difficult time for health services.[49–52]

Food insecurity and mental health remain among the top public health areas of concern identified by the *Healthy People 2030* national objectives but warrant even more attention owing to exacerbation from the COVID-19 pandemic.[53] Currently, screening for food insecurity is recommended at least annually by multiple professional medical organizations, including the American Academy of Pediatrics, American Academy of Family Physicians, and American College of Physicians.[54] Given the associations between food insufficiency

and mental health symptoms during the COVID-19 pandemic, clinicians should consider food insecurity and mental health screening at every in-person or telehealth visit using validated 1- to 2-question measures.[54,55] Clinicians can provide referrals to or aid in enrollment in SNAP, WIC, National School Lunch and Breakfast Programs, and community food distribution programs for patients who experience food insecurity.[56] Interventions for food insecurity and mental health may also be integrated into social service programs. For example, programs aimed to assist people who are food insecure, such as SNAP and WIC, could incorporate screening for mental health in their assessments.[24] Conversely, public mental health programs may also screen for and address issues of food insecurity.

Although policies and legislation made early in the pandemic such as the Families First Coronavirus Response Act (H.R. 6201)[57] and the Coronavirus Aid, Relief, and Economic Security Act (H.R. 748)[58] temporarily suspended time limits for SNAP enrollment and allocated funding for newly eligible households, further legislation is needed given the persistence of the pandemic and subsequent food insufficiency. Congress should support the Increasing Access to SNAP Delivery During COVID-19 Act of 2020 (H.R. 6904),[59] which increases access to food delivery during the pandemic, and the SNAP Online Purchasing Flexibility Act of 2020 (H.R. 6510),[60] which authorizes all states to participate in the SNAP online purchasing program and approved retail stores to accept SNAP benefits through online transactions.

Limitations

There are several limitations in this study. First, all measures used in the study are self-reported, which may be subject to reporting bias. However, the anonymity and online nature of the survey may minimize this concern. Second, respondents could choose to view questions and not select a response, which may introduce some selection bias. Third, this survey was cross-sectional, thus limiting the study's ability to ascribe a causal interpretation of the observed association between food insufficiency and symptoms of poor mental health. Finally, the Census HPS used a single-item measure of food insufficiency (often considered the most extreme form of food insecurity) rather than the more comprehensive measure of food insecurity. Although this is an important limitation, a number of previously published studies also used this or a similar single-item measure,[17,24,61,62] and previous research demonstrated the ability to estimate food insecurity using food insufficiency measures from the Census HPS.[4] The study's strengths included nationally representative data recently collected during the COVID-19 pandemic.

CONCLUSIONS

This study adds to previous literature by demonstrating that the association between food insufficiency and poor mental health symptoms is attenuated among people who receive free groceries and meals. Future COVID-19–related policies should aim to increase public awareness of and provide additional funding to school food programs and food banks.[63] These sources of free groceries and meals may increase access to food among those who are food insufficient and help to mitigate poor mental health outcomes. Given the confluence of material need insecurities, nonfood-related interventions to alleviate food insufficiency

should be considered, including paid sick leave, rent/mortgage delays, and stimulus funding for the recently unemployed. Targeted studies that improve the understanding of the social and structural impact of COVID-19 on food security/sufficiency are needed to effectively mitigate the virus's negative effects, especially in communities of color. Health and social support service interventions that grant access to healthy nutritious meals as well as mental health support are urgently needed.

ACKNOWLEDGMENTS

The authors would like to thank Sam Benabou for providing editorial assistance.

The funders had no role in the study design, data collection, and analysis, the decision to publish the study, or the preparation of the manuscript.

JMN is supported by the American Heart Association Career Development Award (CDA34760281). ACT is supported by the Sullivan Family Foundation. SDW is supported by the National Institute of Allergy and Infectious Diseases (K24AI134326).

JMN conceptualized the study, conducted the analyses, led the writing, and revised the manuscript. KTG, HJW, and OOH drafted and revised the manuscript. JC contributed to the analyses and drafted and revised the manuscript. ACT and SDW conceptualized the study, reviewed and revised the manuscript, and supervised the study.

No financial disclosures were reported by the authors of this paper.

REFERENCES

1. Coleman-Jensen A, Rabbitt MP, Gregory C, Singh A. Household food security in the United States in 2018. Washington, DC: Economic Research Service, U.S. Department of Agriculture; 2019. https://www.ers.usda.gov/publications/pub-details/?pubid=94848. Published 2019. Accessed December 8, 2020.
2. Chilton M, Rose D. A rights-based approach to food insecurity in the United States. Am J Public Health. 2009;99(7):1203–1211. 10.2105/AJPH.2007.130229. [PubMed: 19443834]
3. Briefel RR, Woteki CE. Development of food sufficiency questions for the third national health and nutrition examination survey. J Nutr Educ. 1992;24(1)(suppl 1):24S–28S. 10.1016/S0022-3182(12)80134-8.
4. Schanzenbach D, Pitts A. How much has food insecurity risen? Evidence from the census household pulse survey. Evanston, IL: Institute for Policy Research Rapid Research Report, Northwestern University; 2020. https://www.ipr.northwestern.edu/documents/reports/ipr-rapid-research-reports-pulse-hh-data-10-june-2020.pdf. Published 2020. Accessed December 8, 2020.
5. Kaiser Family Foundation. State COVID-19 data and policy actions. San Francisco, CA: Kaiser Family Foundation. https://www.kff.org/coronavirus-covid-19/issue-brief/state-data-and-policy-actions-to-address-coronavirus/. Published January 27, 2021. Accessed January 27, 2021.
6. Dunn CG, Kenney E, Fleischhacker SE, Bleich SN. Feeding low-income children during the COVID-19 pandemic. N Engl J Med. 2020;382(18):e40. 10.1056/NEJMp2005638. [PubMed: 32227759]
7. Jyoti DF, Frongillo EA, Jones SJ. Food insecurity affects school children's academic performance, weight gain, and social skills. J Nutr. 2005;135(12):2831–2839. 10.1093/jn/135.12.2831. [PubMed: 16317128]
8. Huang J, Barnidge E, Kim Y. Children receiving free or reduced-price school lunch have higher food insufficiency rates in summer. J Nutr. 2015;145(9):2161–2168. 10.3945/jn.115.214486. [PubMed: 26203095]

9. Bradley K, Galt RE. Practicing food justice at Dig Deep Farms & Produce, East Bay Area, California: self-determination as a guiding value and intersections with foodie logics. Local Environ. 2014;19(2):172–186. 10.1080/13549839.2013.790350.
10. de Paulo Farias D, dos Santos Gomes MG. COVID-19 outbreak: what should be done to avoid food shortages? Trends Food Sci Technol. 2020;102:291–292. 10.1016/j.tifs.2020.06.007. [PubMed: 32834501]
11. Akter S The impact of COVID-19 related 'stay-at-home' restrictions on food prices in Europe: findings from a preliminary analysis. Food Secur. 2020;12(4):719–725. 10.1007/s12571-020-01082-3. [PubMed: 32837638]
12. Weiser SD, Young SL, Cohen CR, et al. Conceptual framework for understanding the bidirectional links between food insecurity and HIV/AIDS. Am J Clin Nutr. 2011;94(6):1729S–1739S. 10.3945/ajcn.111.012070. [PubMed: 22089434]
13. Kirkpatrick SI, Tarasuk V. Food insecurity is associated with nutrient inadequacies among Canadian adults and adolescents [published correction appears in J Nutr. 2008;138(7):1399]. J Nutr. 2008;138(3):604–612. 10.1093/jn/138.3.604. [PubMed: 18287374]
14. Seligman HK, Laraia BA, Kushel MB. Food insecurity is associated with chronic disease among low-income NHANES participants. J Nutr. 2010;140(2):304–310. 10.3945/jn.109.112573. [PubMed: 20032485]
15. Gundersen C, Ziliak JP. Food insecurity and health outcomes. Health Aff (Millwood). 2015;34(11):1830–1839. 10.1377/hlthaff.2015.0645. [PubMed: 26526240]
16. Pooler JA, Hartline-Grafton H, DeBor M, Sudore RL, Seligman HK. Food insecurity: a key social determinant of health for older adults. J Am Geriatr Soc. 2019;67(3):421–424. 10.1111/jgs.15736. [PubMed: 30586154]
17. Nagata JM, Palar K, Gooding HC, Garber AK, Bibbins-Domingo K, Weiser SD. Food insecurity and chronic disease in U.S. young adults: findings from the National Longitudinal Study of Adolescent to Adult Health. J Gen Intern Med. 2019;34(12):2756–2762. 10.1007/s11606-019-05317-8. [PubMed: 31576509]
18. Talevi D, Socci V, Carai M, et al. Mental health outcomes of the COVID-19 pandemic. Riv Psichiatr. 2020;55(3):137–144. 10.1708/3382.33569. [PubMed: 32489190]
19. Ganson KT, Tsai AC, Weiser SD, Benabou SE, Nagata JM. Job insecurity and symptoms of anxiety and depression among U.S. young adults during COVID-19. J Adolesc Health. 2021;68(1):53–56. 10.1016/j.jadohealth.2020.10.008. [PubMed: 33183926]
20. Ganson KT, Weiser SD, Tsai AC, Nagata JM. Associations between anxiety and depression symptoms and medical care avoidance during COVID-19. J Gen Intern Med. 2020;35(11):3406–3408. 10.1007/s11606-020-06156-8. [PubMed: 32875507]
21. Taylor HO, Taylor RJ, Nguyen AW, Chatters L. Social isolation, depression, and psychological distress among older adults. J Aging Health. 2018;30(2):229–246. 10.1177/0898264316673511. [PubMed: 28553785]
22. Lyden J, Binswanger IA. The United States opioid epidemic. Semin Perinatol. 2019;43(3):123–131. 10.1053/j.semperi.2019.01.001. [PubMed: 30711195]
23. Bruening M, Dinour LM, Chavez JBR. Food insecurity and emotional health in the USA: a systematic narrative review of longitudinal research. Public Health Nutr. 2017;20(17):3200–3208. 10.1017/S1368980017002221. [PubMed: 28903785]
24. Nagata JM, Palar K, Gooding HC, et al. Food insecurity is associated with poorer mental health and sleep outcomes in young adults. J Adolesc Health. 2019;65(6):805–811. 10.1016/j.jadohealth.2019.08.010. [PubMed: 31587956]
25. Palar K, Frongillo EA, Escobar J, et al. Food insecurity, internalized stigma, and depressive symptoms among women living with HIV in the United States. AIDS Behav. 2018;22(12):3869–3878. 10.1007/s10461-018-2164-8. [PubMed: 29948333]
26. Lent MD, Petrovic LE, Swanson JA, Olson CM. Maternal mental health and the persistence of food insecurity in poor rural families. J Health Care Poor Underserved. 2009;20(3):645–661. 10.1353/hpu.0.0182. [PubMed: 19648695]

27. Whittle HJ, Sheira LA, Wolfe WR, et al. Food insecurity is associated with anxiety, stress, and symptoms of posttraumatic stress disorder in a cohort of women with or at risk of HIV in the United States. J Nutr. 2019;149(8):1393–1403. 10.1093/jn/nxz093. [PubMed: 31127819]
28. Whittle HJ, Sheira LA, Frongillo EA, et al. Longitudinal associations between food insecurity and substance use in a cohort of women with or at risk for HIV in the United States. Addiction. 2019;114(1):127–136. 10.1111/add.14418. [PubMed: 30109752]
29. Pryor L, Lioret S, van der Waerden J, Fombonne É, Falissard B, Melchior M. Food insecurity and mental health problems among a community sample of young adults. Soc Psychiatry Psychiatr Epidemiol. 2016;51(8):1073–1081. 10.1007/s00127-016-1249-9. [PubMed: 27294729]
30. Nagata JM, Gomberg S, Hagan MJ, Heyman MB, Wojcicki JM. Food insecurity is associated with maternal depression and child pervasive developmental symptoms in low-income Latino households. J Hunger Environ Nutr. 2019;14(4):526–539. 10.1080/19320248.2018.1434101. [PubMed: 31673300]
31. Arenas DJ, Thomas A, Wang JC, DeLisser HM. A systematic review and meta-analysis of depression, anxiety, and sleep disorders in U.S. adults with food insecurity. J Gen Intern Med. 2019;34(12):2874–2882. 10.1007/s11606-019-05202-4. [PubMed: 31385212]
32. Measuring household experiences during the coronavirus pandemic. U.S. Census Bureau. https://www.census.gov/householdpulsedata. Updated January 12, 2021. Accessed July 23, 2020.
33. Definition of human subjects research. HHS, NIH; 2020. https://grants.nih.gov/policy/humansubjects/research.htm. Accessed October 14, 2020.
34. Chen W, Qian L, Shi J, Franklin M. Comparing performance between log-binomial and robust Poisson regression models for estimating risk ratios under model misspecification. BMC Med Res Methodol. 2018;18 (1):63. 10.1186/s12874-018-0519-5. [PubMed: 29929477]
35. McNutt LA, Wu C, Xue X, Hafner JP. Estimating the relative risk in cohort studies and clinical trials of common outcomes. Am J Epidemiol. 2003;157(10):940–943. 10.1093/aje/kwg074. [PubMed: 12746247]
36. Zou G A modified Poisson regression approach to prospective studies with binary data. Am J Epidemiol. 2004;159(7):702–706. 10.1093/aje/kwh090. [PubMed: 15033648]
37. Whittle HJ, Leddy AM, Shieh J, et al. Precarity and health: theorizing the intersection of multiple material-need insecurities, stigma, and illness among women in the United States. Soc Sci Med. 2020;245:112683. 10.1016/j.socscimed.2019.112683. [PubMed: 31760320]
38. van Dorn AV, Cooney RE, Sabin ML. COVID-19 exacerbating inequalities in the U.S. Lancet. 2020;395(10232):1243–1244. 10.1016/S0140-6736(20)30893-X. [PubMed: 32305087]
39. McClure ES, Vasudevan P, Bailey Z, Patel S, Robinson WR. Racial capitalism within public health: how occupational settings drive COVID-19 disparities. Am J Epidemiol. 2020;189(11):1244–1253. 10.1093/aje/kwaa126. [PubMed: 32619007]
40. Himmelstein KEW, Venkataramani AS. Economic vulnerability among U.S. female health care workers: potential impact of a $15-perhour minimum wage. Am J Public Health. 2019;109(2):198–205. 10.2105/AJPH.2018.304801. [PubMed: 30571300]
41. Harris OO, Leblanc N, McGee K, Randolph S, Wharton MJ, Relf M. Alarm at the gate-health and social inequalities are comorbid conditions of HIV and COVID-19. J Assoc Nurses AIDS Care. 2020;31 (4):367–375. 10.1097/JNC.0000000000000190. [PubMed: 32568762]
42. Boyd RW, Lindo EG, Weeks LD, Mclemore MR. On racism: a new standard for publishing on racial health inequities. HealthAffairs. 2020 July 2. 10.1377/hblog20200630.939347.
43. Bureau of Labor Statistics, U.S. Department of Labor. The employment situation−June 2020. Washington, DC: Bureau of Labor Statistics, U.S. Department of Labor; 2020. https://www.bls.gov/news.release/archives/empsit_07022020.pdf. Published 2020. Accessed July 23, 2020.
44. Iriondo J. Income, poverty and health insurance coverage in the United States: 2018. Suitland-Silver Hill, MD: U.S. Census Bureau; 2019. https://www.census.gov/newsroom/press-releases/2019/income-poverty.html. Published 2019. Accessed July 23, 2020.
45. Semega J, Kollar M, Creamer J, Mohanty A. Income and poverty in the United States: 2018. Suitland-Silver Hill, MD: U.S. Census Bureau; 2019. https://www.census.gov/content/dam/

Census/library/publications/2019/demo/p60-266.pdf. Published 2019. Accessed December 8, 2020.

46. Whittle HJ, Palar K, Seligman HK, Napoles T, Frongillo EA, Weiser SD. How food insecurity contributes to poor HIV health outcomes: qualitative evidence from the San Francisco Bay Area. Soc Sci Med. 2016;170:228–236. 10.1016/j.socscimed.2016.09.040. [PubMed: 27771206]
47. Hamelin AM, Beaudry M, Habicht JP. Characterization of household food insecurity in Québec: food and feelings. Soc Sci Med. 2002;54 (1):119–132. 10.1016/s0277-9536(01)00013-2. [PubMed: 11820676]
48. Bergmans RS, Wegryn-Jones R. Examining associations of food insecurity with major depression among older adults in the wake of the Great Recession. Soc Sci Med. 2020;258:113033. 10.1016/j.socscimed.2020.113033. [PubMed: 32535473]
49. Afulani PA, Coleman-Jensen A, Herman D. Food insecurity, mental health, and use of mental health services among nonelderly adults in the United States. J Hunger Environ Nutr. 2020;15(1):29–50. 10.1080/19320248.2018.1537868.
50. Baggett TP, Singer DE, Rao SR, O'Connell JJ, Bharel M, Rigotti NA. Food insufficiency and health services utilization in a national sample of homeless adults. J Gen Intern Med. 2011;26(6):627–634. 10.1007/s11606-011-1638-4. [PubMed: 21279455]
51. Mangurian C, Sreshta N, Seligman H. Food insecurity among adults with severe mental illness. Psychiatr Serv. 2013;64(9):931–932. 10.1176/appi.ps.201300022.
52. Whittle HJ, Wolfe WR, Sheira LA, et al. Associations between food insecurity and psychotropic medication use among women living with HIV in the United States. Epidemiol Psychiatr Sci. 2020;29:E113. 10.1017/S2045796020000232. [PubMed: 32248873]
53. Healthy People 2030. HHS, Office of Disease Prevention and Health Promotion. https://health.gov/healthypeople. Accessed October 14, 2020.
54. Patil SP, Craven K, Kolasa K. Food insecurity: how you can help your patients. Am Fam Physician. 2018;98(3):143–145. https://pubmed.ncbi.nlm.nih.gov/30215895/. [PubMed: 30215895]
55. Kleinman RE, Murphy JM, Wieneke KM, Desmond MS, Schiff A, Gapinski JA. Use of a single-question screening tool to detect hunger in families attending a neighborhood health center. Ambul Pediatr. 2007;7(4):278–284. 10.1016/j.ambp.2007.03.005. [PubMed: 17660098]
56. Nagata JM, Seligman HK, Weiser SD. Perspective: the convergence of coronavirus disease 2019 (COVID-19) and food insecurity in the United States. Adv Nutr. 2020 In press. Online September 24.
57. Families First Coronavirus Response Act. H.R. 6201, 116th Cong (2019−2020).
58. CARES Act. H.R. 748, 116th Cong (2019−2020).
59. Increasing Access to SNAP Delivery During COVID-19 Act of 2020. H.R. 6904, 116th Cong. (2019−2020).
60. SNAP Online Purchasing Flexibility Act of 2020. H.R. 6510, 116th Cong. (2019−2020).
61. Nagata JM, Palar K, Gooding HC, et al. Food insecurity, sexual risk, and substance use in young adults. J Adolesc Health. 2021;68(1):169–177. 10.1016/j.jadohealth.2020.05.038. [PubMed: 32682597]
62. Nagata JM, Weiser SD, Gooding HC, Garber AK, Bibbins-Domingo K, Palar K. Association between food insecurity and migraine among U.S. young adults. JAMA Neurol. 2019;76(9):1121–1122. 10.1001/jamaneurol.2019.1663. [PubMed: 31233123]
63. Jablonski BBR, Casnovsky J, Clark JK, et al. Emergency food provision for children and families during the COVID-19 pandemic: examples from five U.S. cities. Appl Econ Perspect Policy. 2020 In press. Online October 22.
64. United States Department of Agriculture. US Household Food Security Survey Module: Three-Stage Design, with Screeners. Washington, D.C.; 2012. https://www.ers.usda.gov/media/8271/hh2012.pdf. Accessed October 15, 2020.
65. United States Department of Agriculture. Food Security in the United States. https://www.ers.usda.gov/data-products/food-security-in-the-united-states/. Published 2020. Accessed October 14, 2020.

66. Spitzer RL, Kroenke K, Williams JBW, Löwe B. A brief measure for assessing generalized anxiety disorder: The GAD-7. Arch Intern Med. 2006;166(10):1092–1097. 10.1001/archinte.166.10.1092. [PubMed: 16717171]

67. Kroenke K, Spitzer RL, Williams JBW. The PHQ-9: Validity of a brief depression severity measure. J Gen Intern Med. 2001;16(9):606–613. 10.1046/j.1525-1497.2001.016009606.x. [PubMed: 11556941]

68. Nagata JM, Magerenge RO, Young SL, Oguta JO, Weiser SD, Cohen CR. Social determinants, lived experiences, and consequences of household food insecurity among persons living with HIV/AIDS on the shore of Lake Victoria, Kenya. AIDS Care - Psychol Socio-Medical Asp AIDS/HIV. 2012;24(6):728–736. 10.1080/09540121.2011.630358.

Table 1.

Description of Measures

Measure	Description
Food insufficiency	Participants were asked, “In the last 7 days, which of these statements best describes the food eaten in your household?” Potential response options included: “Enough of the kinds of food (I/we) wanted to eat”, “Enough, but not always the kinds of food (I/we) wanted to eat”, “Sometimes not enough to eat”, and “Often not enough to eat”. The response options “Enough of the kinds of food (I/we) wanted to eat” and “Enough, but not always the kinds of food (I/we) wanted to eat” were categorized as food sufficient, while the response options “Sometimes not enough to eat” and “Often not enough to eat” were categorized as food insufficient as reported by the U.S. Census.[36] The questions regarding food sufficiency were consistent with the U.S. Household Food Security Survey Module.[64] Food insufficiency generally describes whether households have enough food for their families to eat and is often the most extreme form of food insecurity.[3] In other surveys, such as the Current Population Survey’s Food Security Supplement, 86%−89% of people reporting food insufficiency were deemed food insecure.[4]
Received free food or groceries	“During the last 7 days, did you or anyone in your household get free groceries or a free meal?” Response options included “yes” or “no”. This item was included in order to determine the extent of receipt of food aid and to determine sources of food aid as below to inform policy and resource allocation during the COVID-19 pandemic.
Where did you get free groceries or food?	This item was asked of participants who responded “yes” to receiving free food or groceries and was measured using the question “Where did you get free groceries or free meals?” Potential response options included “Free meals through the school or other programs aimed at children”, “Food pantry or food bank”, “Home-delivered meal service like Meals on Wheels, Church, synagogue, temple, mosque or other religious organization”, “Shelter or soup kitchen”, “Other community program”, and “Family, friends, or neighbors”. These factors were chosen as part of the U.S. public-use household-level Current Population Survey Food Security Supplement (CPS-FSS), which was designed to understand where Americans receive food aid in relation to food insecurity.[65] In addition, from a policy level, it is important to determine what proportion of Americans are receiving free food during the pandemic and where they are getting the food aid from. This can inform resource allocation for federal and state policies as part of the Coronavirus relief legislation.
Mental health symptoms	Mental health symptoms were measured using questions adapted from the 7-item Generalized Anxiety Disorder scale (GAD-7)[66] and the 9-item Patient Health Questionnaire (PHQ-9),[67] which are used to screen for generalized anxiety disorder and major depressive disorder, respectively. Participants were asked how often they had symptoms of anxiety, worry, anhedonia (lack of interest), and depression over the last 7 days. Potential response options for each question included “Not at all”, “Several days”, “More than half the days”, and “Nearly every day”. Each variable was dichotomized such that “Not at all” indicated the absence of the symptom and “Several days”, “More than half the days”, and “Nearly every day” indicated the presence of the symptom (i.e., any days).
Demographic variables	Demographic variables that may be associated with food insufficiency and potential confounders in the association between food insufficiency and poor mental health include age, sex, race/ethnicity, marital status, number of children in the household, and number of adults in the household.[22,27,54,68]
SES	Socioeconomic variables that may be associated with food insufficiency and potential confounders in the association between food insufficiency and poor mental health include employment loss in the past 7 days, federal poverty level, and education.[17,22,68]

CPS-FSS, Current Population Survey Food Security Supplement; GAD-7, Generalized Anxiety Disorder scale 7; PHQ, Patient Health Questionnaire-9.

Table 2.

Demographic Characteristics of U.S. Census Household Pulse Survey by Food Sufficiency Status, June 2020 (N=63,674)

Demographics	Total[a]	Food sufficient[a]	Food insufficient[a]	*p*-value
Age, mean ± SE	48.46 ± 0.21	49.26 ± 0.23	41.09 ± 0.56	**<0.001** [b]
Sex, %				0.065[c]
Female	51.50	51.09	55.35	
Male	48.50	48.91	44.65	
Race/ethnicity, %				**<0.001** [c]
White alone, not Hispanic	63.71	65.99	43.71	
Black alone, not Hispanic	10.97	9.99	19.32	
Asian alone, not Hispanic	4.98	5.19	3.17	
A total of ≥2 races + other races, not Hispanic	3.93	3.87	4.54	
Hispanic or Latino (may be of any race)	16.41	14.96	29.26	
Married, %	56.24	58.50	35.92	**<0.001** [c]
Number of children in household, mean ± SE	0.68 ± 0.01	0.65 ± 0.01	1.00 ± 0.07	**<0.001** [b]
Number of adults in household, mean ± SE	2.72 ± 0.02	2.70 ± 0.03	2.92 ± 0.07	**0.005** [b]
Employment loss, past 7 days, %	47.65	44.41	76.45	**<0.001** [c]
Below federal poverty level, %	20.16	16.30	54.42	**<0.001** [c]
Education, %				**<0.001** [c]
High school or less	37.69	34.85	62.61	
More than high school	62.31	65.15	37.39	
Food insufficiency, June 11–16, 2020, %	10.02	—	—	
Food insufficiency, before March 13, 2020, %	8.07	1.87	63.52	**<0.001** [c]
Received free groceries or meals, past 7 days, %	9.36	8.24	19.46	**<0.001** [c]
School program, %	4.07	3.61	8.20	**<0.001** [c]
Food pantry or food bank, %	2.85	2.30	7.91	**<0.001** [c]
Home delivery, %	0.31	0.27	0.59	0.085[c]

Demographics	Total[a]	Food sufficient[a]	Food insufficient[a]	*p*-value
Religious organization, %	1.93	1.67	4.36	**<0.001** [c]
Food shelter or soup kitchen, %	0.12	0.07	0.52	**0.001** [c]
Other community program, %	1.77	1.56	3.57	**0.027** [c]
Family, friends, or neighbors, %	2.48	2.03	6.65	**<0.001** [c]
Any symptoms of poor mental health, past 7 days, %	72.40	70.04	93.76	**<0.001** [c]
Anxious, %	65.21	62.55	89.47	**<0.001** [c]
Worrying, %	56.09	52.52	88.11	**<0.001** [c]
Little interest, %	53.52	50.42	81.68	**<0.001** [c]
Depressed, %	52.37	48.87	83.42	**<0.001** [c]

Note: Boldface indicates statistical significance ($p<0.05$).

[a] All means and percentages were calculated with weighted data to reflect the representative proportion in the target U.S. population.

[b] Independent samples *t*-tests.

[c] Pearson's chi-square tests.

Table 3.

Demographic and Socioeconomic Associations With Food Insufficiency in U.S. Census Household Pulse Survey, June 2020

Demographics	Food insufficiency	
	RR (95% CI)	*p*-value
Age (per 10 years)	0.77 (0.74, 0.80)	**<0.001**
Sex		
Female	ref	
Male	0.89 (0.77, 1.04)	0.13
Race/ethnicity		
White alone, not Hispanic	ref	
Black alone, not Hispanic	2.57 (2.15, 3.08)	**<0.001**
Asian alone, not Hispanic	0.89 (0.54, 1.45)	0.631
Atotal of ≥2 races + other races, not Hispanic	1.76 (1.31, 2.35)	**<0.001**
Hispanic or Latino (may be of any race)	2.58 (2.14, 3.11)	**<0.001**
Married	0.71 (0.60, 0.83)	**<0.001**
Number of children in household	1.23 (1.16, 1.31)	**<0.001**
Number of adults in household	1.08 (1.04,1.12)	**<0.001**
SES		
Employment loss, past 7 days	3.45 (2.93, 4.06)	**<0.001**
Income below federal poverty line	4.25 (3.69, 4.90)	**<0.001**
Education (high school or less)	2.74 (2.39, 3.13)	**<0.001**

Note: Boldface indicates statistical significance ($p<0.05$).

Table 4.

Associations Between Food Insufficiency and Poor Mental Health Symptoms in U.S. Census Household Pulse Survey, June 2020

Mental health outcomes, past 7 days	Food insufficiency, past 7 days, overall sample		Food insufficiency, past 7 days, among people who received free groceries or meals		Food insufficiency, past 7 days, among people who did not receive free groceries or meals		Interaction[a] *p*-value
	ARR (95% CI)	*p*-value	ARR (95% CI)	*p*-value	ARR (95% CI)	*p*-value	
Any symptoms of poor mental health	1.16 (1.11,1.21)	**<0.001**	1.07 (0.99,1.16)	0.079	1.20 (1.14, 1.25)	**<0.001**	**0.004**
Anxious	1.26 (1.21, 1.32)	**<0.001**	1.15 (1.07, 1.24)	**<0.001**	1.29 (1.24, 1.35)	**<0.001**	**0.001**
Worrying	1.39 (1.33, 1.45)	**<0.001**	1.28 (1.17,1.40)	**<0.001**	1.42 (1.34,1.49)	**<0.001**	**0.003**
Little interest	1.35 (1.28, 1.43)	**<0.001**	1.25 (1.10, 1.41)	**<0.001**	1.38 (1.30, 1.46)	**<0.001**	**0.024**
Depressed	1.42 (1.35, 1.50)	**<0.001**	1.28 (1.14,1.44)	**<0.001**	1.46 (1.38,1.55)	**<0.001**	**0.005**

Note: Boldface indicates statistical significance ($p<0.05$).

All models included age, race/ethnicity, marital status, number of children in household, number of adults in household, employment loss, income, and education as covariates.

[a] *p*-value for food insufficiency and received free groceries or meals interaction.

ARR, adjusted RR.