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Food Insecurity and Dietary Changes During Covid-19 in the San Francisco Bay Area

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FOOD INSECURITY AND DIETARY CHANGES DURING COVID-19 IN THE SAN FRANCISCO BAY AREA

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ABSTRACT

FOOD INSECURITY AND DIETARY CHANGES DURING COVID-19
IN THE SAN FRANCISCO BAY AREA

by Iris Vanessa Tablas-Mejia

Shelter-in-place and social distancing protocols were issued across the country to contain the spread of the novel coronavirus (COVID-19); however, these safety measures gave rise to unprecedented unemployment rates and disruptions to food access. This study investigated how COVID-19 affected food security and food consumption patterns in the San Francisco Bay Area. A validated survey developed by the National Food Access and COVID Research Team (NFACT) was distributed online from August to November 2020. The survey measured food access and eating behaviors during the pandemic. Seven hundred and twenty-four participants (403 female, 76 male, average age 43.9 ± 15.0 years) completed the online survey. Food insecurity in the Bay Area increased from 18.9% to 33.1% since the COVID-19 outbreak; 14.2% participants were newly food insecure (F.I.). Most newly F.I. participants were women (51.5%, P=0.0204), and they were three times more likely to be F.I. than males (P<0.01). Food insecurity was also significantly more prevalent among Hispanics (P<0.01), households with children (P<0.05), participants with an annual income <$35,000 ($P$<0.001), participants who experienced a job disruption during the pandemic (P<0.001), and those who earned less than an associate's degree (P<0.001). Lastly, participants who consumed fewer fruits and vegetables (F.V.) during the pandemic were nearly six times as likely to be F.I. than those who consumed more or about the same F.V. (P<0.001). The results illustrate the need to address food access disparities among women, Hispanics, and households with children.

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LIST OF ABBREVIATIONS

ANOVA:	analysis of variance
AOR:	adjusted odds ratio
CI:	confidence interval
CPS-FSS:	Current Population Survey Food Security Supplement
COVID-19:	novel coronavirus
FAO:	Food and Agriculture Organization of the United Nations
FV:	fruits and vegetables
NFACT:	National Food Access and COVID Research Team
NHANES:	National Health and Nutrition Examination Survey
OR:	odds ratio
P-EBT:	Pandemic-Electronic Benefits Transfer
SDOH:	social determinants of health
SNAP:	Supplemental Nutrition Assistance Program
USDA:	United States Department of Agriculture
WHO:	World Health Organization
WIC:	Special Supplemental Nutrition Program for Women, Infants & Children

CHAPTER 1

Literature Review

Introduction

On January 21, 2020, the United States reported its first confirmed novel coronavirus (COVID-19) case (WHO, 2020a). Ten days later, Santa Clara County reported its first new COVID-19 case. Though the virus had spread across multiple countries since January, the WHO did not declare COVID-19 a pandemic until March 11, 2020. On March 17, shelter-in-place orders went into effect in six Bay Area counties — Alameda, Contra Costa, Marin, San Mateo, San Francisco, and Santa Clara — to slow the spread of the virus. Sonoma, Solano, and Napa counties followed suit within the next couple of days (Allday, 2020). Despite these efforts, COVID-19 cases continued to run rampant. In mid-September, approximately six weeks after launching our survey, the total number of confirmed COVID-19 cases in the Bay Area exceeded 96,000 (ABC7 News, 2020), contributing to the more than 6.5 million confirmed cases in the U.S. between January 20, 2020, and September 17, 2020 (WHO, 2020b). By February 2, 2021, the total number of confirmed COVID-19 cases in the Bay Area nearly quadrupled, jumping to 376,935 total cases, 4,265 of which resulted in death (Chronicle Digital Team, 2021). Social distancing protocols and bans of large public gatherings forced non-essential businesses to shut down, resulting in historically high unemployment rates. According to the U.S. Bureau of Labor Statistics (BLS, 2020a), 16.3 million people across the country were unemployed in July, or 10.2% of the population. The BLS (2020b) also reports that unemployment rates in the Bay Area jumped from 3.5% in March to 11.3% in July. By January 2021, the national unemployment rate was 6.7% —

nearly twice the rate of 3.5% in February 2020 before COVID-19 was declared a pandemic. Similar to the national figure, the average unemployment rate in the Bay Area was 6.9% by the end of 2020 (BLS, 2021a). Unprecedented unemployment rates, long lines at grocery stores, and food shortages due to panic shopping have likely influenced purchasing decisions and eating behaviors. This review will provide an overview of the social determinants of health, food security, and nutrition-related health outcomes and present research on how the COVID-19 pandemic may have impacted these conditions.

Social Determinants of Health

Food security, employment, and access to health care services have been areas of concern during the COVID-19 pandemic. Still, they share something else in common: they are examples of social determinants of health (SDOH), which the WHO (2021a) defines as "non-medical factors that influence health outcomes." More specifically, SDOH are "conditions in the environments where people are born, live, learn, work, play, worship, and age that affect a wide range of health, functioning, and quality-of-life outcomes and risks" (Healthy People 2030, 2021a). Healthy People 2030 developed the SDOH framework and organized various "place-based" conditions into five categories (determinants): economic stability, education access, and quality, health care access and quality, neighborhood and built environment, and social and community context. A disruption in one of these determinants could have a ripple effect on one's health outcomes. For instance, someone who has lost their job or had reduced hours would experience financial instability, making it difficult to afford housing, medicine, or nutritious foods. As noted by Healthy People 2030 (2021b), having access to foods that support healthy eating patterns can have lifelong benefits related to managing calorie intake.

Broader access may improve consumption of a wider variety of fruits, vegetables, whole grains, and protein. Food access is associated with a reduced risk of chronic diseases, such as hypertension and type 2 diabetes. Paradoxically, the U.S. has the worst health outcomes — lower life expectancy, higher infant mortality rates, and greater prevalence of chronic diseases — compared to other high-income countries such as Japan and Germany, despite spending more on health care than its peers (Rollston & Galea, 2020).

The COVID-19 outbreak highlighted the effects that socioeconomic status and "place" have on health outcomes. Low-wage workers, e.g., retail and restaurant employees, experienced more unemployment or reduced hours following shelter-in-place orders because their roles could not be performed from home (Sandhu et al., 2021). Hourly workers deemed essential during the pandemic, such as grocery store clerks, had greater exposure to the virus by working in an environment with high foot traffic. Essential workers' exposure to the virus only increased if they had to take public transportation to commute to work. Furthermore, to offset other basic living expenses, low-income individuals may find themselves living in overcrowded homes, an environment that would also accelerate the spread of COVID-19 (Rollston & Galea, 2020). Indeed, Perez et al. (2020) report that eight of the 10 ZIP codes with the highest COVID-19 deaths in New York City were also associated with low-income neighborhoods primarily populated by minority groups, specifically Asian, Latinx, and Black households. Across the United States, Black individuals were more likely to contract COVID-19 and die from the virus, with 88 deaths per 100,000, compared to 40 deaths per 100,000 among the white population (O'Hara & Toussaint, 2021; Shah et al., 2020). Exposure to the virus is due in part to place of employment. For instance, 22% of Uber

drivers are Black, many of whom cite Uber as their primary source of income (Hossain, 2021). While choosing not to drive during the pandemic would've reduced their exposure to COVID-19, doing so would've also threatened their livelihood.

Food Security

Food security status occurs on a spectrum, ranging from highly food secure to very low food secure. Since 2006, the United States Department of Agriculture (USDA) has used the following labels to categorize food security: high food security, marginal food security, low food security, and very low food security. Individuals have high food security if they report no incidents of food access problems. Marginal food security is still considered food secure; individuals at this level reported having one or two episodes of "anxiety over food sufficiency or shortage of food in the house," but these concerns result in little or no changes to their food intake (USDA, 2020a). On the other end of the spectrum is low food security, characterized by reports of reduced quality or variety of food intake, but not necessarily the quantity. Very low food security involves multiple incidents of reduced food intake, regardless of quality or variety. In addition to creating these food security categories, the USDA clearly distinguishes between food insecurity and hunger. Hunger and food insecurity are related, but the two terms are not interchangeable. *Hunger* is physical discomfort that occurs at an individual level that may or may not result from food insecurity.

Food insecurity, on the other hand, is a consistent lack of adequate food at the household level. More specifically, the USDA (2020b) defines food insecurity as "the limited or uncertain availability of nutritionally adequate and safe foods, or limited or uncertain ability to acquire acceptable foods in socially acceptable ways." By contrast, food secure households

have the "assured ability to acquire acceptable foods in socially acceptable ways (that is, without resorting to emergency food supplies, scavenging, stealing, or other coping strategies)" (USDA, 2020b). Healthy People 2020 (2019) describes food insecurity as "the disruption of food intake or eating patterns because of lack of money and other resources." Disruptions in food intake can involve eating less desirable foods, drastically reducing portions to make one's food supply last longer, or skipping meals altogether. Additionally, the Food and Agriculture Organization of the United Nations (FAO, 2008) provides the following definition for food security: "Food security exists when all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (p. 1). This definition encompasses four dimensions of food security: availability, access, utilization, and stability. More specifically, food must be both physically available and economically and physically accessible; it must also provide sufficient energy and nutrients that can be utilized by the body, as these elements contribute to nutrition status. Stability refers to an individual's ability to consistently maintain the other three dimensions, which can be jeopardized by external factors such as adverse weather conditions, unemployment, and rising food costs (FAO, 2008).

The Current Population Survey Food Security Supplement (CPS-FSS), conducted by the U.S. Census Bureau each year since 1995, collects data on food security and food-related hardships. Approximately 40,000 households responded to the food security survey, which includes questions such as the following: "In the last 12 months, did you or other adults in the household ever cut the size of your meals or skip meals because there wasn't enough

money for food?" and "In the last 12 months, were you ever hungry, but didn't eat, because there wasn't enough money for food?" (Economic Research Service, 2012). Food security can be measured with an 18-item, 10-item, or 6-item validated survey module — each with its own set of pros and cons. The 18-item U.S. Household Food Security Survey Module is a "three-stage design with screeners" and includes questions for households with children under the age of 18 (USDA, 2020c). Most households with children are only asked five questions to determine their food security reliably despite the survey length. While the 18-item module is more precise, it can be perceived as overwhelming, laborious, or intrusive, mainly because of the questions pertaining to children of the household's food security. The 10-item U.S. Adult Food Security Survey Module is similar to the 18-item household module in both its three-stage design and questions, but it does not contain child-referenced questions. However, this adult module can still be used to assess the food security of households with children. While the USDA recommends using either the 18- or 10-item modules, the National Center for Health Statistics designed a 6-item short form of the U.S. Household Food Security Survey Module for instances in which the more extended modules cannot be implemented in a survey. The short form further reduces survey respondent burden while still identifying food insecure households. However, it does not ask questions about the household children's food security and thus may not be as precise as the more extended modules (USDA, 2020c).

Food insecurity rates in the United States have been far from steady over the past two decades. From 2001 to 2007, the food insecurity rate in the U.S. had remained at approximately 11% for all households, while households with children had a food insecurity

rate of almost 18% (Gundersen & Ziliak, 2015). Following the onset of the Great Recession, food insecurity rose from 11.1% in December 2007 to 14.7% in 2009 for all households (Rabbitt et al., 2017). Furthermore, Balistreri (2016) found that during and after the recession, "the food insecure became even more insecure and the severity increased for those at the extreme levels" (p. 380), especially in households without children. According to the Business Cycle Dating Committee of the National Bureau of Economic Research (2010), the Great Recession officially ended in June 2009; however, food insecurity rates did not immediately follow. The food insecurity rate for all households peaked at 14.9% in 2011 and didn't drop to pre-recession rates until 2018 (Economic Research Service, 2020; Rabbitt et al., 2017). The following year, the prevalence of food insecurity in the United States dropped from 11.1% in 2018 to 10.5% in 2019. According to the USDA (2020b), 8.3 million households (6.4%) in the U.S. experienced low food security in 2019, and another 5.3 million households (4.1%) experienced very low food security.

Suppose economic access is a component of food security. In that case, it is no surprise that households with incomes below 185% of the federal poverty line represent 28.6% of the food insecure population in the U.S. (USDA, 2021). Furthermore, in U.S. households with children under 18 years old, 2.4 million households reported that adults and children experienced food insecurity in 2019. According to the USDA (2020b), the following groups also experience food insecurity at greater rates than the national average: all households with children, especially households with children younger than six years old or those headed by a single parent; men and women who live alone; Black, non-Hispanic households; and Hispanic households. The USDA (2020b) also reports that suburban households are less

likely to experience food insecurity than urban and rural households. If food insecurity is a predictor of health, then one can surmise that the above groups are more susceptible to adverse health outcomes.

Food Security and Health Outcomes

Much research has been conducted on the association between food security and various health outcomes: nutrient intake, overall health status, and prevalence of chronic nutrition-related diseases. These are all components of malnutrition, a condition that includes "undernutrition, inadequate vitamins or minerals, overweight, obesity, and resulting diet-related noncommunicable diseases" (WHO, 2021b). Existing literature suggests that low-income households have limited access to healthy food, which ultimately affects their nutritional status. In their Portland-based study, Breyer and Voss-Andreae (2013) determined that a combination of unit prices and proximity to grocery stores can create disparities in access to healthy foods and diet-related health outcomes. Indeed, energy-dense foods are more financially accessible than nutrient-dense foods. After adjusting for energy, Drewnowski (2010) found that polyunsaturated fats, total fats, carbohydrates, and sweets are cheaper than fruits and vegetables per 100 grams. Furthermore, unprocessed and minimally processed foods cost significantly more than ultra-processed foods: $1.44/100 kcal compared to $0.55/100 kcal, respectively (S. Gupta et al., 2019). Not surprisingly, food insecure households tend to buy cheaper, energy-dense foods to stretch their food budget. Following their systematic review, Hanson and Connor (2014) concluded that food insecure adults have poorer dietary quality than food secure adults. The authors found "significant adverse associations between food insecurity and specific measures of dietary quality" (Hanson &

Connor, 2014, p. 690). Specifically, food insecure adults consume fewer fruits, vegetables, and dairy products than those who are food secure. Consequently, food insecure adults have an increased risk of developing nutrition-related chronic diseases (Yaroch et al., 2012). Additionally, food insecure adults are less likely to study nutrition facts labels and prioritize price when comparing food to purchase (Ranjit et al., 2020). These shopping practices further lend to undesirable food choices.

Shopping behaviors and reduced food intake associated with food insecurity could result in nutrient deficiencies, a component of malnutrition, notably if one eliminates a food group deemed more expensive than others. For instance, food insecure adults who consume fewer fruits, vegetables, and dairy products have lower intakes of vitamin A and B_6, calcium, magnesium, and zinc (Yaroch et al., 2012). The higher cost of animal protein can also result in reduced intake of the essential mineral iron. According to S. Gupta et al. (2019), fresh meat, fish, and other seafood are more costly per 100 grams, compared to sweets, grains, and fats. Though nonheme iron can be obtained by consuming plant-based foods such as beans and tofu, the heme iron in animal protein is more easily absorbed in our bodies. Not surprisingly, Eicher-Miller et al. (2009) found that adolescents in food insecure homes have reduced animal protein intake, resulting in iron deficiency anemia. Furthermore, 12-15 year old children in food insecure homes are almost three times more likely to be iron deficient than their food secure peers. In younger food insecure children, the odds of developing iron deficiency are even more significant: 8 times greater in 6-11-year-olds and 11 times greater in 3-5-year-olds. According to Park et al. (2009), infants and toddlers in households with very low food security were twice as likely to develop iron deficiency and iron deficiency

anemia compared to those in households with high food security. The rapid growth and muscle development that children undergo — in addition to menses for adolescent girls — demand higher iron intake. Long-term iron deficiency develops over months or even years; if left untreated, it can negatively affect children's behavior and impair their cognitive abilities (Mesías et al., 2013; Park et al., 2009). There is not enough evidence demonstrating an association between food insecurity and iron deficiency anemia in U.S. adults, and Miller (2013) points out that iron deficiency is reversible over time. However, successful resolution of the disease largely depends on consuming an adequate amount of iron, so it may still be a nutrient of concern for food insecure households with children.

It is almost counterintuitive that instances of reduced portions or missed meals altogether would be associated with obesity, another component of malnutrition. However, researchers have found food insecurity to be paradoxically associated with obesity — a phenomenon referred to as the *food-insecurity obesity paradox*. Some researchers hypothesize that low food-secure populations consume more cheap, high-calorie foods that tend to be high in added sugar and saturated fat. Another common hypothesis is that low food-secure people have limited knowledge, time, and/or resources for healthy eating and exercise (Dhurandhar, 2016). In a study of 13,720 young men and women aged 24-32 years old, Gooding et al. (2012) found that food insecurity is associated with increased BMI in young adult women, regardless of their ethnic or racial background, socioeconomic status, education, and other health-related variables. Though this was not true for young men, this study illustrates the food-insecurity obesity paradox in young women. Metallinos-Katsaras et al. (2012) found that chronic low food security during infancy increased preschool-aged children's odds of

being obese by 22%, with even greater odds if their mother was overweight or obese before conception. If food insecurity increases the risk of obesity, it likely has an indirect relationship with developing some of the chronic diseases associated with obesity, namely cardiovascular disease and type 2 diabetes (Ofei, 2005).

Diabetes and hypertension are two of the health conditions that have been studied in relation to food insecurity. As overconsumption of added sugars and saturated fats has been observed in food insecure populations, Seligman et al. (2010) studied the association between food insecurity and diseases related to these energy sources: diabetes, hypertension, and hyperlipidemia, which indicates that an individual has a high concentration of lipids in their blood. According to their results, food insecure adults have a 21% greater risk of being diagnosed with hyperlipidemia than those who are food secure. Additionally, 22.4% of food insecure adults had hypertension, compared to 18.6% of food secure adults. Finally, food insecure adults had double the risk of diabetes than their food secure peers. For those already diagnosed with diabetes, food insecurity also hindered their ability to manage the disease. Based on their findings, Seligman et al. (2010) suggested that food insecurity could be a risk factor for hypertension and diabetes.

Researchers have also investigated whether there is an association between food insecurity and respiratory diseases. Family history, exposure to secondhand smoke, and a history of respiratory infections are some of the more common risks associated with asthma. However, in an unprecedented study, Mangini et al. (2015) found a relationship between food insecurity and asthma in elementary school-aged children. Based on a sample of more than 11,000 third-graders from the Early Childhood Longitudinal Study-Kindergarten Cohort

(ECLS-K), asthma was significantly more prevalent in poor, food insecure households identified as non-Hispanic white and non-Hispanic black, but especially in the Hispanic demographic. According to Mangini et al. (2015), Hispanic children are 35% more likely to develop asthma if they're food insecure, with their odds doubling if their household is both food insecure and living below the poverty threshold. While this 2015 study identified a relationship between food insecurity and asthma, the authors did not explain the association. However, a subsequent investigation by the same authors suggests that three factors associated with food insecurity — obesity, malnutrition, and stress — likely contribute to the increased prevalence of asthma in young children (Mangini et al., 2018).

Based on the lack of literature suggesting otherwise, food insecurity does not appear to cause or increase the prevalence of asthma in adults. However, a study by Nagata et al. (2019) may be the first to illustrate an association between food insecurity and obstructive airway disease in young adults (ages 24-32), specifically those who report having asthma, chronic bronchitis, or emphysema. Being food insecure can be a stressor, and the researchers explain that "[s]tress may lead to greater inflammation, which is involved in the pathophysiology of asthma, and more frequent asthma exacerbations" (Nagata et al., 2019, p. 2760). The relationship between asthma and food allergies could be another way food insecurity contributes to asthma exacerbations. Nagata et al. (2019) believe that those experiencing food insecurity may find it more challenging to avoid food allergens that trigger their asthma attacks. Contributing to the research on food insecurity and asthma, Palakshappa et al. (2019) found that food-insecure adults with obesity — especially obese adults experiencing very low food security — were significantly more likely to have asthma

compared to obese adults who are food secure. The authors believe that limited resources due to food insecurity make it difficult for obese adults to incorporate lifestyle changes that would help reduce their risk of developing or exacerbating obesity-related comorbidities. Becerra et al. (2019) also found that asthma is significantly more prevalent in food insecure adults than food secure adults. Additionally, food insecure adults with asthma are "nearly 1.5 times more likely to delay prescription, as compared to their food secure counterparts" (Becerra et al., 2019, p. 251). The authors suggest that food insecure adults might choose to forego buying asthma medication to have more money for food. While food insecurity may not be the direct cause of chronic health conditions, the studies by Becerra et al. (2019), Nagata et al. (2019), and Palakshappa et al. (2019) demonstrate how food insecurity can function as a barrier to improved health outcomes.

Food Insecurity and COVID-19

Food insecurity is characterized by limited or uncertain access to adequate food and is related to socioeconomic status and the food environment; the pandemic has undoubtedly impacted these factors for millions of Americans. Based on a model that assumes an average unemployment rate of 10.5% and an average poverty rate of 14.4%, Feeding America (2020) predicted that approximately 50 million people (15.6%) would experience food insecurity in 2020 following the COVID-19 outbreak. Additionally, Feeding America predicted that California would see the most significant *increase* in food insecure people and the largest *total* number of people experiencing food insecurity: 1.9 million and 6.2 million, respectively. Before the pandemic, California was one of 11 states with an estimated prevalence of food insecurity *below* the national average, based on a three-year average

between 2017 and 2019 (USDA, 2020b). Studies conducted both nationally and within specific regions further outline the pandemic's effect on food security. In their research on food insecurity in Washington, D.C., O'Hara and Toussaint (2021) describe food insecurity as "both a cause and symptom of COVID-19 and its swelling death toll" (pp. 5-6). Firstly, those who lost their jobs because of the pandemic no longer had the financial means to obtain the appropriate amount or quality of food. Secondly, meat packing factories, food distribution centers, and full-service grocery stores in D.C. — which continued operating throughout the pandemic — primarily employ low-wage workers. These workers' socioeconomic status limited their access to affordable, nutritious foods before the pandemic. This health disparity only made them more vulnerable to contracting COVID-19 because, as suggested by Seligman et al. (2010), food insecurity can be a risk factor for chronic diseases.

Furthermore, Nagata et al. (2021) posit that contracting COVID-19 can exacerbate food insecurity because symptoms associated with the virus — fever, cough, fatigue, muscle or body aches, shortness of breath — could prevent those infected from going to work. Those who are asymptomatic must also quarantine at home, resulting in fewer hours worked. This mainly affects individuals working in retail or food service who cannot work from home, and any healthcare costs associated with treating the virus would reduce their food budget. Indeed, Restrepo et al. (2021) found that total food spending was 15.0% lower in households with at least one adult who became unemployed due to pandemic-related business closures than fully employed households. Additionally, the researchers found that households with an unemployed member were 9.5% less likely to report having sufficient food, 21% less likely to feel confident about their ability to obtain the food they need in the future, and 35.7%

more likely to receive free food from food assistance programs. In Vermont, food insecure households increased by 32.3% between the year before the COVID-19 outbreak and since COVID-19 was declared a pandemic, 35.5% of which were newly food insecure (Niles, Bertmann, et al., 2020). Furthermore, the statewide Vermont study results indicate that 32.3% of newly food insecure households experienced very low food insecurity, while 67.7% experienced low food insecurity. At the time of the study, Vermont's unemployment claims mirrored that of the nation's (Niles, Bertmann, et al., 2020), which suggests that the food insecurity trends the researchers captured would be consistent across the United States, including the San Francisco Bay Area.

Barriers and Strategies

Procuring adequate, affordable, and nutritious food required food insecure households to employ multiple strategies before the pandemic, but social distancing protocols made it even more challenging. Shoppers often found themselves waiting in long lines to enter grocery stores, as proprietors in the Bay Area set a maximum capacity of 20% to facilitate social distancing (Narayan & Said, 2020). Food hoarding made it challenging to find staples such as rice, beans, and grains, particularly in March when much of the Bay Area began to shelter in place (Finney & Yip, 2020; Narayan & Said, 2020). Recipients of the Supplemental Nutrition Assistance Program (SNAP) and the Special Supplemental Nutrition Program for Women, Infants and Children (WIC) are already limited to which items they can purchase using their benefits, and not all grocery stores accept SNAP benefits; panic shopping further reduced the availability of SNAP- and WIC-eligible food items (Kinsey et al., 2020; Martinelli et al., 2020). Though SNAP allowed all its recipients to make online purchases using their benefits

during the pandemic, not all recipients could do so. Nearly a quarter of SNAP beneficiaries in Arizona reported that they were unable to use their benefits online, which would've made it safer to obtain food (Martinelli et al., 2020). Social distancing disrupted other food purchasing practices utilized by urban households experiencing food insecurity: visiting multiple stores to find the best deals, using public transportation or rideshare services to travel to more affordable grocery stores, and dining at community kitchens. More importantly, these practices place food insecure households at a greater risk of being exposed to the coronavirus.

Similar to food retailers, public transportation enforced passenger limits to help contain the spread of COVID-19. A.C. Transit (2020), which services Alameda and Contra Costa counties, implemented a 10-passenger threshold for its 40' standard buses. The San Francisco Municipal Transportation Agency (2021) temporarily reduced or removed some of its Muni routes during its COVID-19 response. Both A.C. Transit and Muni buses would skip stops if they were close to capacity. While these passenger limits were designed to protect the health and safety of riders, they've also made shopping trips more time-consuming and inconvenient.

However, ride-sharing services were generally perceived to be riskier than other modes of transportation, regardless of socioeconomic status. Interestingly, in their study on transportation in Columbus, OH, Ozbilen et al. (2021) found that individuals with an annual household income less than $45,000 perceived traveling riskier in terms of COVID-19 exposure than those with a yearly household income of $99,000-$149,999. Thus, households without a car may have continued to rely on public transportation for their grocery store trips,

despite the convenience that ride-sharing could have afforded them when bus capacities and routes were limited.

In response to the barriers generated by social distancing protocols, local food banks modified their services to aid their communities better. According to the SF-Marin Food Bank (2020), their organization has served approximately 60,000 households every week during the pandemic — nearly double the number of households that relied on them before the pandemic. Though the SF-Marin Food Bank closed one-third of its 275 pantries due to safety concerns, the organization opened 27 emergency pop-up pantries throughout San Francisco and Marin to meet the increasing demand for food. Additionally, the organization expanded its home delivery service to low-income, homebound senior citizens and people with disabilities — an effort that helped decrease their risk of food insecurity and COVID-19 exposure. Second Harvest of Silicon Valley (n.d.), one of the largest food banks in the country, also reports serving twice as many people since the onset of the pandemic: 500,000 recipients per month since COVID compared to 250,000 recipients pre-COVID. To meet the increased needs of their community, Second Harvest opened more than 130 drive-thru pantry sites and launched a home delivery service. These solutions not only helped reach more food insecure households, but they also helped reduce their volunteers' and food recipients' exposure to the deadly virus. However, households who utilized food pantries during the pandemic did note some challenges, notably long lines and wait times, inconvenient hours, and limitations to how frequently they could visit a pantry site (Ohri-Vachaspati et al., 2020).

Conclusion

The national food insecurity rates projected and observed since the onset of the COVID-19 pandemic haven't been seen since the Great Recession. The current rates should be concerning, as this review highlights the detrimental role that food insecurity plays in both short- and long-term health outcomes. Research shows that food insecure households base their food purchases on price rather than nutritional value, making it challenging to achieve a healthy, balanced diet; avoid foods that might trigger or exacerbate existing conditions; and reduce the risk of developing nutrition-related chronic diseases like diabetes and hypertension. Unfortunately, the social distancing protocols designed to protect people from infection also contributed to the unprecedented unemployment rates, which placed more households at risk of being food insecure. Furthermore, such protocols likely interfered with where and how households obtained food.

The COVID-19 pandemic impacted the social determinants of health related to economic stability and access to nutritious foods. Still, we do not yet understand the depth of the disparities created by the pandemic. Studies in various regions of the country show a spike in the number of households experiencing food insecurity in the earlier stages of the pandemic. During the Great Recession, those who were already food insecure became even more so. Feeding America offers national and statewide projections of food insecurity post-pandemic. Still, it is unclear if the California projections are better or worse than what was experienced in the Bay Area. There is also a growing body of research presenting some of the challenges that U.S. households have faced in utilizing nutrition assistance programs since March 2020, such as inconvenient hours and the inability to use benefits online. To our knowledge, there

are no other studies explicitly focused on how Bay Area residents fared during the pandemic. Chapter Two will explore how shelter-in-place orders affected the food security and eating behaviors of Bay Area residents. Having a better understanding of how the pandemic affected food security and diet outcomes in a U.S. metropolitan area and which groups are at increased risk of food security would help inform local policymakers on best serving some of the most vulnerable members of their community.

CHAPTER 2

Journal Article

FOOD INSECURITY AND DIETARY CHANGES DURING COVID-19
IN THE SAN FRANCISCO BAY AREA

Abstract

Introduction: Shelter-in-place and social distancing protocols were issued across the country to contain the spread of the novel coronavirus (COVID-19); however, these safety measures gave rise to unprecedented unemployment rates and disruptions to food access. This study investigated how COVID-19 affected food security and food consumption patterns in the San Francisco Bay Area.

Methods: A validated survey developed by the National Food Access and COVID Research Team (NFACT) was distributed online from August to November 2020. The survey measured food access and eating behaviors during the pandemic.

Results: Seven hundred and twenty-four participants (403 female, 76 male, average age 43.9 ± 15.0 years) completed the online survey. Food insecurity in the Bay Area increased from 18.9% to 33.1% since the COVID-19 outbreak; 14.2% participants were newly food insecure (F.I.). Most newly F.I. participants were women (51.5%, P=0.0204), and they were three times more likely to be F.I. than males ($P<0.01$). Food insecurity was also significantly more prevalent among Hispanics ($P<0.01$), households with children ($P<0.05$), participants with an annual income <$35,000 ($P<0.001$), participants who experienced a job disruption during the pandemic ($P<0.001$), and those who earned less than an associate's degree ($P<0.001$). Lastly, participants who consumed fewer fruits and vegetables (F.V.) during the pandemic

were nearly six times as likely to be F.I. than those who consumed more or about the same F.V. (P<0.001).

Conclusion: The results illustrate the need to address food access disparities among women, Hispanics, and households with children.

Keywords: COVID-19 (coronavirus disease 2019), food insecurity, food security, food access, Hispanic/Latinx, women of color, people of color

Introduction

On January 21, 2020, the United States reported its first confirmed novel coronavirus (COVID-19) case [1]. Ten days later, Santa Clara County in Northern California reported its first new COVID-19 case. Though the virus had spread across multiple countries since January, the WHO did not declare COVID-19 a pandemic until March 11, 2020. On March 17, shelter-in-place orders went into effect in six Bay Area counties — Alameda, Contra Costa, Marin, San Mateo, San Francisco, and Santa Clara — to slow the spread of the virus. Sonoma, Solano, and Napa counties followed suit within the next couple of days [2]. In mid-September, approximately six weeks after launching our survey, the total number of confirmed COVID-19 cases in the Bay Area exceeded 96,000 [3], contributing to the more than 6.5 million confirmed cases in the U.S. between January 20, 2020, and September 17, 2020 [4]. By February 2, 2021, the total number of confirmed COVID-19 cases in the Bay Area nearly quadrupled, jumping to 376,935 total cases, 4,265 of which resulted in death [5]. Social distancing protocols and bans of large public gatherings forced non-essential businesses to shut down, resulting in historically high unemployment rates. According to the BLS, 16.3 million people across the country were unemployed in July 2020, or 10.2% of the population [6]. The BLS also reports that unemployment rates in the Bay Area jumped from 3.5% in March to 11.3% in July 2020 [7]. By January 2021, the national unemployment rate was 6.7% — nearly twice the rate of 3.5% in February 2020 before COVID-19 was declared a pandemic. Similar to the national figure, the average unemployment rate in the Bay Area was 6.9% by the end of 2020 [8-10].

The COVID-19 pandemic has impacted the social determinants of health related to economic stability and access to nutritious foods. Unprecedented unemployment rates, long lines at grocery stores, and food shortages due to panic shopping have likely influenced purchasing decisions and eating behaviors. However, we do not yet understand the depth of the disparities created by the pandemic. Studies in various country regions show a spike in the number of households experiencing food insecurity in the earlier stages of the pandemic [11-14]. Feeding America offers national and statewide projections of food insecurity [15]. Still, it is unclear if the California projections are better or worse than what was experienced in the Bay Area. There is also a growing body of research presenting some of the challenges that U.S. households have faced in utilizing nutrition assistance programs since March 2020, such as inconvenient hours and the inability to use benefits online [16-19].

Economic access is a component of food security, and existing literature suggests that unit prices are one reason why low-income households have limited access to healthy food [20]. Indeed, energy-dense foods containing excess sugar, sodium, and saturated fats are cheaper per calorie than nutrient-dense foods like fruits, vegetables, and low-fat dairy products [21, 22]. Furthermore, food insecure adults are less likely to study nutrition facts labels and prioritize price when comparing food to purchase [23] — shopping practices that lend to undesirable food choices. Specifically, food insecure adults tend to buy cheaper, energy-dense foods to stretch their food budget and consume fewer fruits, vegetables, and dairy products than those who are food secure [24]. Consequently, food insecure adults have an overall poorer diet quality compared to food secure adults. Food insecurity may not directly cause chronic health conditions, but various studies demonstrate how food insecurity

can function as a barrier to positive health outcomes. In Seligman et al.'s study, food insecure adults had double the risk of being diagnosed with diabetes than their food secure peers [25]. For those already diagnosed with diabetes, limited resources due to food insecurity hindered their ability to manage the disease. Similarly, food insecure adults with asthma may find it more challenging to avoid food allergens that trigger their asthma attacks, and compared to food secure adults, they are also 1.5 times more likely to forego buying asthma medication as a food budgeting strategy [26, 27].

To our knowledge, there are no other studies explicitly focused on how residents of the Bay Area — a U.S. metropolitan area comprised of a diverse population in one of the most expensive regions of the country — fared during the pandemic. Thus, the purpose of this study is to investigate how the pandemic has affected the food security status and food consumption patterns of Bay Area residents. Our research questions are threefold: (1) How did food security status (food secure, newly food insecure, consistently food insecure) vary by sociodemographic factors during the pandemic?; (2) What sociodemographic factors were associated with food insecurity during the pandemic?; and (3) Were changes in dietary intake during the pandemic associated with food security status? Having a better understanding of how the pandemic affected food access and behaviors in the Bay Area would help inform local policymakers on serving some of the most vulnerable members of their community.

Methods

Participant Recruitment

To learn about food security trends and changes in dietary intake during the pandemic, an online survey was distributed in the San Francisco Bay Area and Santa Cruz, CA via

Qualtrics from August to November 2020. The survey was available in both English and Spanish. Bay Area residents aged 18+ who have lived in the United States since at least January 2020 were invited to participate. Considering that the Bay Area adult population was 5,466,882, a minimum sample size of 600 participants would have been needed to achieve a 95% confidence level for a +/- 4% margin of error [28, 29]. Participants were recruited through paid Facebook ads, community outreach partners, and social media platforms: Twitter, Instagram, LinkedIn, NextDoor, Craigslist, and Yelp Talk. The survey was also advertised for two weeks in October 2020 on *El Tecolote's* website, the online publication of the San Francisco-based bilingual newspaper. Participants were excluded from the study if they did not live in Santa Cruz or one of the nine Bay Area counties (Alameda, Contra Costa, Marin, Napa, San Francisco, San Jose, San Mateo, Santa Clara, and Solano). The survey questions were adapted from the validated survey "Food access and food security during COVID-19 Survey Version 2.1," developed by the National Food Access and COVID Research Team (NFACT), showing an alpha validity above 0.70 [30]. This survey measures food access, program assistance use, and food purchasing behaviors and includes demographics, job disruptions, and concerns about food availability during the pandemic. The study was approved by San José State University's Institutional Review Board.

Demographics

Data on age, gender, race/ethnicity, occupation, income, education level, household composition, and employment disruption were collected in the survey. To measure disruptions in employment, participants were asked if they lost their job, were furloughed,

experienced reduced hours or income, or had no changes to their job since the COVID-19 outbreak.

Assessment of Food Security

The U.S. Department of Agriculture's (USDA) Household Food Security Survey Module: Six-Item Short form was implemented in the survey to measure food security. Questions were adapted to ask about two time periods: "in the year before the COVID-19 outbreak" and "since the COVID-19 outbreak." In this survey, March 11, 2020, is used as the start date for the COVID-19 outbreak because this was when the WHO declared the outbreak a pandemic. Thus, questions that ask about "the year before the COVID-19 outbreak" refer to the period between March 11, 2019, and March 10, 2020. Based on the USDA's guidelines, survey respondents who answer affirmatively to 2-4 out of the six short-form questions are classified as having low food security. Those who answer affirmatively to 5-6 questions are classified as having very low food security. These two groups are often combined to describe food insecure households, while the high and marginal food secure groups are combined to describe food secure households [31]. Similar to Niles et al. [12], we also created three categories of survey respondents to evaluate changes in food security status following the COVID-19 outbreak: (1) food secure, which includes households that were food secure before and during the pandemic, as well as those that became newly food secure since the pandemic; (2) newly food insecure, which describes households that were food secure before the pandemic but experienced food insecurity since COVID-19; and (3) consistently food insecure, which describes households that experienced food insecurity before and during the pandemic.

Eating Behaviors

Questions about food intake were prefaced with the following statement: "The next questions are about how you have been eating in the past month during the COVID-19 outbreak (since March 11)."

Assessment of Fruit and Vegetable (F.V.) Intake

This survey adapted questions from the National Cancer Institute's two-item CUP FVS screener to assess fruit and vegetable intake since the onset of the COVID-19 pandemic. According to Yaroch et al., short dietary screeners can be used to "assess gross level estimates and to rank individuals with regard to fruit and vegetable intake" [32, p.1574]. As such, fruit intake was assessed using the following question: "About how many cups of fruit (including 100% pure fruit juice) do you eat or drink each day?" Examples of one cup of fruit provided were 1 small apple, 1 large banana, 1 cup (8 oz.) of 100% juice or canned fruit, or ½ cup of dried fruit. Survey respondents could select one of the following answers to describe their fruit intake: none, ½ cup or less, ½ cup to 1 cup, 1-2 cups, 2-3 cups, 3-4 cups, or 4 cups or more. Vegetable intake was assessed using a similarly worded question.

Assessment of Changes in Diet Intake

This survey adapted questions from the NHANES Food Frequency Questionnaire to assess changes in intake of red meat, processed meats, sugary snacks, salty snacks, and alcoholic beverages since the onset of the pandemic. For instance, red meat intake was assessed using the following question: "How often did you eat red meat (such as beef, pork, ham, sausage, veal lamb)? Do not include chicken, turkey, or seafood. Include red meat you had in sandwiches, lasagna, stew, and other mixtures." Survey respondents could select one

of the following answers to describe their intake: never, 1 time last month, 2-3 times last month, 1 time per week, 2 times per week, 3-4 per week, 5-6 times per week, 1 time per day, or 2 or more times per day. A similarly formatted question assessed the intake of processed meats, sugary snacks, salty snacks, and alcoholic beverages. Participants were then asked whether they were eating more, less, or about the same amount of the following foods since March 11, 2020: fruits and vegetables, processed and red meats, fish and seafood, sugary snacks, salty snacks, and alcoholic beverages.

Data Analysis

Statistical analysis was performed using SAS, and results were considered statistically significant when $p < 0.05$. Incomplete surveys, e.g., those submitted by participants who did not complete the survey or skipped survey questions, were included in the analysis as "Unknown" or "Other" to reduce bias.

To compare descriptive characteristics among the three groups (food secure, consistently food insecure, and newly food insecure combined), analysis of variance (ANOVA) was used for continuous variables and chi-square for categorical variables. A logistic regression model was used to assess the factors associated with higher odds of food insecurity during COVID-19. The newly food insecure and consistently food insecure groups were combined into one food insecure group. The reference group was male, non-Hispanic white, no job disruption, household without children, 60+ years old, income >$35K, and having an advanced degree. A logistic regression model was also used to examine the association between negative changes in diet intake and higher odds of food insecurity during COVID-19 (newly food insecure and consistently food insecure were combined) in a crude model and adjusted for

sociodemographic factors (gender, income, household composition, job disruption, race/ethnicity, education, and age).

Results

Participant Demographics

Seven hundred and twenty-four participants completed the self-administered online questionnaire. The average age of survey respondents was 43.9 years (± 15.0), most of whom were female (n=403, 55.7%), had advanced degrees (25%), and earned $35K-$150K annually (32.7%) (Table 1). The majority of participants were classified as Unknown (n=295, 40.7%). Because so few participants identified as Black or Native American, they were combined with the "Other" race/ethnicity category, and the "Other" group was then combined with the Unknown group for statistical analysis. Two hundred and twenty-three participants were White (30.8%), 122 were Latinx/Hispanic (16.9%), and 84 were Asian (11.6%). One hundred and sixty-six participants experienced a job disruption (22.9%), but most participants did not (n=471, 65.0%). Two hundred and three participants indicated they lived in households with children under 18 years of age (28.0%), 104 participants did not live with children (14.4%), and 417 participants did not describe their household composition (57.6%).

Food Insecurity Prevalence and Characteristics

Nearly 67% of participants were food secure after the pandemic (n=484), 14.23% were newly food insecure (n= 103), and 18.92% were consistently food insecure (n= 137). Most participants who remained food secure after the pandemic were White (36.57%), and most consistently food insecure participants were Latinx (28.47%). However, an equal number of White and Latinx participants became newly food insecure (21.36%). The majority of newly

Table 1

Descriptive Characteristics and Factors Associated with Food Insecurity (Chi-square and ANOVA)

	Overall n = 724	**Food secure** n = 484	**Newly food insecure** n = 103	**Consistently food insecure** n = 137	**p-value**
Age, m ± sd	43.9 (15.0)	45.8 (14.9)	41.6 (14.3)	38.8 (12.7)	0.0002
Gender, n (%)					
Female	403	275 (56.82%)	53 (51.46%)	75 (54.74%)	0.0204
Male	76	61 (12.60%)	8 (7.77%)	7 (5.11%)	
Unknown	245	148 (30.58%)	42 (40.78%)	55 (40.15%)	
Race/Ethnicity n (%)					
Asian	84	64 (13.22%)	7 (6.80%)	13 (9.49%)	<0.0001
Hispanic	122	61 (12.60%)	22 (21.36%)	39 (28.47%)	
White	223	177 (36.57%)	22 (21.36%)	24 (17.52%)	
Other/Unknown	295	182 (37.60%)	52 (50.49%)	61 (44.53%)	
Income n (%)					
<35 k	96	33 (6.82%)	15 (14.56%)	48 (35.04%)	<0.0001
35k-150k	237	156 (32.23%)	43 (41.75%)	38 (27.74%)	
>150k	134	133 (27.48%)	1 (0.97%)	0	
Unknown	257	162 (33.47%)	44 (42.72%)	51 (37.23%)	
Education n(%)					
Associate or less	169	74 (15.29%)	35 (33.98%)	60 (43.80%)	<0.0001
Bachelor's	136	105 (21.69%)	13 (12.62%)	18 (13.14%)	
Advanced degree	185	163 (33.68%)	15 (14.56%)	7 (5.11%)	
Unknown	234	142 (29.34%)	40 (38.83%)	52 (37.96%)	
Household composition n(%)					
with children	203	123 (25.41%)	29 (28.16%)	51 (37.23%)	0.0073
without children	104	83 (17.15%)	11 (10.68%)	10 (7.30%)	
Unknown	417	278 (57.44%)	63 (61.17%)	76 (55.47%)	
Employment disruption(%)					
No job loss	471	373 (77.07%)	39 (37.86%)	59 (43.07%)	<0.0001
Job loss	166	64 (13.22%)	47 (45.63%)	55 (40.15%)	
Unknown	87	47 (9.71%)	17 (16.50%)	23 (16.79%)	
F&V intake (cups/d), m ± sd	3.1	3.4 (1.8)	2.9 (2.1)	2.3 (1.9)	<0.0001

ANOVA for continuous variables and Chi-square for categorical variables

food insecure survey respondents were female, had an annual income of $35K-$150K, earned less than an associate's degree, experienced a job disruption, and lived in a household with children under 18. Consistently food insecure survey respondents shared similar

characteristics; most were female, earned less than an associate's degree, and lived in a household with children under 18. However, most of this group had an annual income of <$35K and had not experienced a job disruption after the pandemic (Table 1).

The results illustrate significantly higher odds of food insecurity based on household composition, gender, race, employment disruption, education, and income. For instance, households with children were twice as likely to be food insecure than households without children (OR 2.21; 95% CI, 1.06-4.60) (Table 2). Female participants were three times more likely to be food insecure than males (OR 3.12; 95% CI, 1.38-7.09), and Latinx participants were twice as likely to be food insecure than non-Hispanic whites (OR 2.35; 95% CI, 1.26-4.39). Furthermore, participants who experienced employment disruption after the pandemic were four times more likely to be food insecure than those who did not (OR 4.46; 95% CI, 2.71-7.33). Not surprisingly, participants with an annual income <$35,000 were almost three times as likely to be food insecure compared to participants with an annual income ≥$35,000 (OR 2.83; 95% CI, 1.53-5.24), and those who earned less than an associate's degree were four times more likely to be food insecure than those who had reached an advanced degree (OR 4.39; 95% CI, 2.33-8.27). Lastly, lower consumption of fruits and vegetables was found to be associated with food insecurity (p <0.05) (Table 2).

Table 2

Factors Associated with Higher Odds of Food Insecurity (Newly FI + Consistently FI), n=527

Model Variables	OR	95% CI
Gender		
Male (reference)	1.00	1.00
Female	3.124 **	1.38 - 7.09
Unknown	5.723 *	1.29 - 25.45
Race/Ethnicity		
Non-Hispanic White (reference)	1.00	1.00
Asian	1.27	0.61 - 2.64
Hispanic	2.351 **	1.26 - 4.39
Other	2.006	0.93 - 4.35
Employment Disruption		
No job loss (reference)	1.00	1.00
Job loss	4.461 ***	2.71 - 7.33
Household Composition		
Without children (reference)	1.00	1.00
With children	2.208 *	1.06 - 4.60
Unknown	1.472	0.70 - 3.09
Age		
60+ (reference)	1.00	1.00
18-20 years	0.685	0.19 - 2.45
21-40 years	1.019	0.43 - 2.40
41-60 years	1.02	0.43 - 2.40
Education		
Advanced degree (reference)	1.00	1.00
Associate's or less	4.389 ***	2.33 - 8.27
Bachelor's degree	1.499	0.76 - 2.96
Unknown	2.707	0.46 - 16.06
Income		
>$35k (reference)	1.00	1.00
<$35 k	2.833 ***	1.53 - 5.24
Unknown	1.154	0.37 - 3.60
Fruit and vegetable serving	0.848 *	0.74 - 0.97

* p<0.05, ** p<0.01, *** p<0.001

Food Consumption

One of the aims of this study was to investigate whether or not there was a relationship between food security status and changes in food intake during the pandemic. In the bivariate logistic regression analysis, participants who consumed fewer fruits and vegetables (F.V.) during the pandemic were nearly eight times more likely to be food insecure compared to

participants who ate more F.V. (OR 7.82; 95% CI, 5.15-11.88) (Table 3), and those who consumed more red and processed meats were nearly twice as likely to be food insecure than those who consumed fewer meats (OR 1.98; 95% CI, 1.15-3.39). However, after adjusting for gender, income, household composition, job disruption, race/ethnicity, education, and age, only changes in consumption of F.V. had a significant association with food insecurity (AOR 5.93; 95% CI, 3.55-9.86). Thus, the multivariate logistic regression analysis suggests no significant association between food insecurity and changes in intake of processed and red meats, fish and seafood, sugary snacks, salty snacks, or alcoholic beverages during the pandemic (Table 3).

Table 3

Associations Between Changes in Food Intake During the Pandemic and Food Insecurity

Factors	Crude OR	95% CI	Adjusted OR	95% CI
Fruits/Vegetables				
Less (=1) vs. More/Same	7.823 ***	5.15 - 11.88	5.92 ***	3.55 - 9.86
Red/processed meats				
More (=1) vs. Same/Less	1.977 *	1.15 - 3.39	1.632	0.84 - 3.18
Sugary snacks				
More (=1) vs. Same/Less	1.1	0.75 - 1.61	1.238	0.76 - 2.01
Salty snacks				
More (=1) vs. Same/Less	1.309	0.870-1.970	1.43	0.85 - 2.41
Alcoholic beverages				
More (=1) vs. Same/Less	0.628	0.38 - 1.03	0.787	0.43 - 1.45

Adjusted for: gender, income, household composition, job disruption, race/ethnicity, education, and age

* p<0.05, ** p<0.01, *** p<0.001

Discussion

Shelter-in-place and social distancing protocols were issued across the country to help contain the spread of COVID-19; however, these safety measures gave rise to unprecedented unemployment rates and disruptions to food access. While many states began lifting capacity limits, reopening non-essential businesses, and relaxing mask mandates as early as May

2020, California adopted a more conservative approach [33]. From August 2020 through June 2021, California implemented a four-tiered, color-coded system to guide each county's reopening plans [34]. Considering the stricter COVID-19 measures issued in California, this study sought to investigate how the pandemic affected food security in the Bay Area, one of the most expensive regions in the U.S. This study found that 14.3% of respondents became food insecure after the COVID-19 outbreak, with female participants representing the majority of the newly food insecure (51.5%) and consistently food insecure (54.7%). In addition to gender, we also found that race/ethnicity, household composition, education, income, and job disruptions were significantly associated with food insecurity.

The majority of our study participants may not have experienced food insecurity, but Latinxs/Hispanics, households with children, and women were among the groups most impacted by the pandemic. Before the pandemic, Latinx households and children were already among the most vulnerable to food insecurity [35]. Nearly 17% of Latinx households with children were food insecure in 2019, with this number rising to more than 47% in 2020 after the COVID-19 outbreak [36]. More than 19% of all Latinxs were food insecure in 2020, making them 2.5 times more likely to be food insecure than non-Hispanic whites [37]. Indeed, our results illustrate a disparity in food security between Latinx and non-Hispanic white households. We did not assess immigration status or English language proficiency in our study. However, González suggests that language barriers and immigration status, particularly in households with mixed immigration status, likely contribute to this disparity among Latinxs living in the United States [36]. Without educational material that is both linguistically and culturally appropriate, monolingual Spanish speakers may not be aware of

or fully understand the food assistance programs in which they are eligible to participate. Former President Donald Trump's public charge rule generated further confusion about program eligibility, leading Latinx households with mixed immigration status to either withdraw from federal nutrition assistance programs or opt out of seeking assistance for fear of deportation [36]. Currently, undocumented non-citizens are ineligible for SNAP. The program imposes a five-year waiting period for "lawfully present non-citizens" before they can become eligible to receive benefits, creating yet another barrier to achieving food security.

Our study joins others that report a spike in food insecurity for all households with children in the months following the pandemic. Compounded by financial hardships experienced during the COVID-19 recession, barriers to utilizing nutrition assistance programs threatened the food security of households with children. Congress attempted to mitigate these barriers with its Families First Coronavirus Act (FFCA), which made "a number of provisions to expand federal nutrition assistance programs," including one that allowed states to "issue pandemic electronic meal replacement benefits (P-EBT) for households with children eligible to receive free or reduced-price school meals, which amounts to a dollar value of roughly $114 per child per month" [16, p.332]. Additionally, each state can increase SNAP benefits up to the maximum amount in times of crisis. However, by mid-2020, 2.5 million households with children across the country were already receiving the maximum benefit amount. The closure of schools and child care centers presented another barrier to food access, especially for those who relied on the National School Lunch Program and School Breakfast Program [11]. Food services provided by

schools and child care centers are worth approximately $30 per child per week and meet up to two-thirds of children's daily nutritional needs, so the closure of these facilities created a financial strain for low-income households with children [38]. According to Dunn et al., "the true cost to families of feeding children is probably higher [than $30 per child per week] because this figure doesn't account for time spent purchasing or preparing foods or the higher price of retail foods as compared with schools' bulk-purchasing rates" [38]. Without additional support, and in the face of increasing food prices, families with children experienced greater difficulties in obtaining the appropriate amount and quality of food for their household.

The growing literature on the impacts of COVID-19 reveals that the severity of food insecurity among households with children has varied between racial groups. In a national study focusing on the period between April 23 and June 23, 2020, food insecurity was found to be twice as high for Black households with children and 60% higher for Latinx households with children, compared to white households with the same family composition [39]. Though white households also experienced food hardships during this eight-week period, their food insecurity rates began to decline in May 2020, while rates among Black and Latinx households remained unchanged and statistically higher. In June 2020, 47% of Black households with children and 52% of Latinx households with children expected to lose employment income in the next four weeks, compared to 29% of white households. Income is related to food security status, and with Black and Latinx households experiencing a greater loss of income, increased worries about food procurement could be expected. Indeed, only 19% of Black households with children and 22% of Hispanic households were "very

confident" that they could afford food in the next four weeks, compared to 49% of white households [39]. These trends in food hardship coincide with employment disruptions during the pandemic.

Non-essential businesses, which generally offer lower wages, were the first to shut down operations and the last to resume at full capacity — safety measures that most impacted the food security of workers in the retail, food service, and hospitality industries. Our results draw a relationship between these employment disruptions and food access: survey respondents who experienced a job disruption are four times more likely to be food insecure than those whose employment was not affected by COVID-19. Indeed, Restrepo et al. found that total food spending was 15.0% lower in households with at least one adult who became unemployed due to pandemic-related business closures, compared to fully employed households [14]. Additionally, the researchers found that households with an unemployed member were 9.5% less likely to report having sufficient food, 21% less likely to feel confident about their ability to obtain the food they need in the future, and 35.7% more likely to receive free food from food assistance programs.

Recent findings suggest a potential relationship between race/ethnicity and the spike in unemployment rates after the outbreak. In Washington, D.C., not only do Latinxs comprise the majority of newly food insecure individuals after the onset of COVID-19, but they also "reported higher rates of lost full-time employment and reduced hours at work due to the pandemic" [40]. Capital Area Food Bank (CAFB) suggests that the disproportionate job disruptions experienced by Latinxs are due in part to the industries in which they worked prior to the pandemic. A greater proportion of Latinxs work in the foodservice and

hospitality industries, while a smaller proportion hold jobs that could be performed remotely [10, 37, 39]. With national and regional studies reporting an overrepresentation of unemployed Latinxs, it is possible that they are driving the employment disruption data in our study, which would further explain why Latinxs emerged as the most food insecure racial/ethnic group in the Bay Area since COVID-19.

The industry in which one was employed prior to the pandemic determined both the likelihood and degree of employment disruption following the shelter-in-place orders, and this was especially true for women. Because the retail and hospitality industries have a higher concentration of female employees than males, women were more likely to be furloughed or become unemployed when COVID-19 safety measures forced non-essential businesses to shut down [41]. School closures also affected women disproportionately compared to men. In a study of 1,060 heterosexual couples with children, Carlson et al. (as cited in Priore, 2020) found that half the couples believed that children's education is the sole responsibility of the mother and, in 73% of the households, "mothers who do the majority of childcare are also solely responsible for educational content" [42, 43]. When schools and daycare centers closed to reduce the risk of infection, women bore the brunt of staying home with their children to facilitate remote learning. Men were also found to overestimate their contributions to housework by more than one hour, resulting in women doing twice the amount of household chores on top of providing childcare and education. Increasing demands at home have forced mothers to reduce their work hours or leave the workforce altogether. This, coupled with the unbalanced hit to female-dominated industries, has led to the COVID-19 recession being dubbed a "shecession" [44]. The fact that female-dominated

jobs tend to be underpaid suggests that newly unemployed women may not have had sufficient savings to withstand a recession, increasing their likelihood of experiencing food insecurity during the pandemic by up to three times the rate of men, as our results indicate. For women of color, the recession has been direr. A study based in Washington, D.C. found that 57.1% of Latinas and 53.6% of Black, non-Hispanic women reported a loss of income since the onset of the pandemic, compared to 41.0% and 40.4% of white, non-Hispanic men and women, respectively [45]. Subsequently, Latinas and Black, non-Hispanic women were more than twice as likely to report food insufficiency compared to white, non-Hispanic males.

This study also sought to investigate the relationship between food insecurity and the intake of various food groups. We found that lower consumption of fruits and vegetables was significantly associated with food insecurity (p <0.0001). Indeed, our results also indicate that food insecure households were more likely to reduce their intake of fruits and vegetables after the pandemic compared to food secure households. Drewnowski confirmed that fresh fruits and vegetables are more expensive than foods with added fats, sugar, and sodium [46], so food insecure households tend to limit their purchase of fresh produce as a budgeting strategy. The timing of food assistance benefits also prevented low-income families from shopping more frequently, which affected their ability to purchase fresh produce and other perishable items more consistently [47]. Circumstantial and environmental factors might further explain the reduced intake in F.V. For instance, limiting one's trips outside the home helped reduce exposure to COVID-19, especially in the earlier stages of the pandemic when vaccines were not yet available. Grocery stores and news outlets encouraged shoppers to

purchase a few weeks' worth of food at a time and stock up on shelf-stable foods to help reduce the frequency of trips to the store. Shelf-stable food items include rice, beans, frozen meals, beef jerky, canned tuna, and canned fruits and vegetables. These items were often out of stock shortly after shelter-in-place orders took effect [48-50], which suggests that shoppers prioritized dry or processed goods over fresh produce as a strategy to minimize their exposure to COVID-19 and reduce food waste.

In April 2020, California announced that it would participate in the SNAP Online Purchasing Pilot, joining five other states that were already participating in this pilot program before the pandemic [16]. SNAP doesn't cover delivery fees, however, and only a few select retailers currently accept SNAP online payments: ALDI, Amazon, FoodMaxx, Lucky Supermarkets, Save Mart Supermarkets, and Walmart. While these grocery store chains' participation in the pilot program is promising, not every location accepts online payments, and not every zip code is included in the online delivery service. One of our Bay Area survey respondents wrote: "There is no Walmart in our area that uses EBT online." Given these limitations, low-income households may have continued to shop in person. The literature describes low-income neighborhoods as being saturated with "low-priced discount stores with affordable but less healthy food products" and lacking supermarkets and grocery stores that offer healthier alternatives [51]. Consequently, low-income households either purchase less healthful foods out of convenience, or they travel greater distances for healthier foods. For low-income households without reliable transportation, COVID-19 safety measures interfered with the tactics they normally employ to acquire nutritious foods, such as visiting multiple stores and/or traveling greater distances for cheaper foods. A recent study found that

low-income residents not only frequented discount stores more often, they also reduced their longer-distance trips to supermarkets and grocery stores during the lockdown and in the initial reopening phase, defined as having begun on April 20, 2020 [51]. Public transportation and ride-sharing options increased the risk of COVID-19 exposure, and local safety measures imposed capacity limits on public transit lines in the Bay Area. Thus, the pandemic made it all the more challenging for low-income households without their own vehicle to find a variety of affordable fruits and vegetables closer to home.

Limitations

Our recruitment methods are both a strength and limitation of the study. While using social media to distribute our survey allowed us to reach a large audience while maintaining social distancing, we may not have reached the populations that are most vulnerable to food security. Limited access to the internet or a device on which to complete the survey may have resulted in low-income populations being under-represented in our study [52]. The use of social media ads and community listservs as a survey distribution method might explain why the majority of participants had earned an advanced degree and why a minority (13.3%) reported an annual income of less than $35,000. Lastly, as the survey contained retrospective questions about the year prior to the pandemic, food intake recalls may be inaccurate.

Despite our efforts to distribute the online survey throughout the Bay Area, our sample is not representative of the region's population. Thirty percent of respondents were white, compared to 50% of the Bay Area population; 17% were Hispanic, compared to 24% of the Bay Area population; and only 2% were Black, although they comprise 6% of the Bay Area. As our survey did not have a sufficient number of Black or Native American respondents, we

were not able to capture how the pandemic affected food access for these populations. The survey length and structure likely hindered our ability to accurately describe the demographics of the study participants. Our survey was divided into five parts, with questions about demographics not appearing until Part 5. The online questionnaire took approximately 20 minutes to complete, so participants may have experienced survey fatigue and started to skip questions by the time they reached the last section, hence the large percentage of "unknown" responses for the demographic characteristics. Thus, it is possible that we had more Black or Native American participants than what is reflected in our results. Future iterations of the survey might introduce the demographics section earlier in the questionnaire to address this limitation.

In an effort to reduce survey respondent burden, our questionnaire incorporates the 6-item short form of the U.S. Household Food Security Survey Module. Given its ability to identify food insecure households and very low food insecure households "with reasonably high specificity and sensitivity and minimal bias," the short form is considered an acceptable substitute for the 10-item U.S. Adult Food Security Survey Module and 18-item U.S. Household Food Security Survey Module [53]. However, the USDA recommends either the 18-item or the 10-item module to measure food security whenever possible. Because the short form does not ask questions about the food security of children in a household, our data on food insecure households with children may not be as precise as it could've been if we had implemented one of the longer modules instead. Future studies may consider using the 10-item module instead.

Conclusion

To our knowledge, this is the first study examining the effects of COVID-19 in the San Francisco Bay Area, one of the most expensive metropolitan areas in the U.S. Our results are consistent with what studies across the country have found: that the pandemic exacerbated food security for populations who were already more susceptible to being food insecure before the pandemic — particularly women of color. We have also established a relationship between food security status and intake of fruits and vegetables. If lower F.V. intake is associated with an increased risk of developing chronic diseases, then the food insecurity rates experienced by women, Latinxs/Hispanics, and households with children during the pandemic may have lasting effects on their health status. As more studies on the impacts of COVID-19 emerge, we are beginning to see the intersectionality of race, gender, and type of employment as it relates to the increased risk of food insecurity. Thus, mitigating negative health outcomes related to food security status would involve making nutrition assistance programs more accessible to households with children and women of color, both in the Bay Area and beyond.

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Declarations

The authors declare no competing interests.

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CHAPTER 3

Summary and Recommendations

Summary

Since March 11, 2020, when the WHO declared COVID-19 a pandemic, the United States saw unemployment and food insecurity rates soar to rates not observed since the Great Recession — the result of public safety measures intended to contain the spread of the virus. Social distancing protocols and food shortages during the earlier stages of the pandemic may have also influenced food consumption patterns. Research on the Great Recession found that individuals who were already food insecure became even more food insecure after the onset of the recession, and food insecurity rates continued to rise years after the recession officially ended in 2009 (Economic Research Service, 2020; Rabbitt et al., 2017). Not surprisingly, studies in various regions of the country show a spike in the number of households experiencing food insecurity in the earlier stages of the pandemic (Nagata et al., 2021; Niles, Belarmino, et al., 2020; O'Hara & Toussaint, 2021; Restrepo et al., 2021). These early findings are concerning, as previous research suggests that food insecurity makes it difficult to achieve a healthy, balanced diet, avoid foods that might trigger or exacerbate existing conditions, and reduce the risk of developing nutrition-related chronic diseases like diabetes and hypertension.

Considering the stricter COVID-19 safety measures issued in California, this study sought to investigate how the pandemic affected food security and food consumption patterns in one of the most expensive metropolitan areas in the U.S. This study found that two-thirds of Bay Area residents were food secure after the COVID-19 outbreak, compared to 81% of

food secure households prior to the pandemic. Furthermore, female participants represented the majority of both the newly food insecure and consistently food insecure. Food insecurity was also found to be significantly more prevalent among Latinxs/Hispanics, households with children, those who earned less than an associate's degree, those with an annual income <$35,000, and those whose employment was disrupted after the pandemic. Lastly, reduced intake of fruits and vegetables during the pandemic was found to be associated with food insecurity. While not explicitly measured in this study, preliminary studies on the impacts of COVID-19 suggest there may be an intersection of race, gender, and type of employment as it relates to the increased risk of food insecurity.

Recommendations

Addressing disparities in food access would require local, statewide, and national efforts. Food banks in the Bay Area either launched home delivery services or expanded existing delivery services and, depending on the county, opened either pop-up pantries or drive-thru pantries to reduce exposure to the virus. Though food banks do not address food security, they should consider maintaining and further expanding these services well after the pandemic to help make nutritious foods more accessible to low-income households. The Biden administration has already taken a step in the right direction by increasing SNAP benefits by 25%, or an additional $36 per person per month, beginning October 1, 2021 (Dewey, 2021). Policymakers should also consider discounting delivery fees or waiving them all together for SNAP participants, reducing the amount of time lawfully present non-citizens must wait to be eligible for SNAP benefits, and recruiting more retailers that accept SNAP online payments. Finally, as discussed in Chapter 2, some of the underlying contributors to

food insecurity include low wages, especially in the retail, food service, and hospitality industries, and lack of access to child care, which disproportionately affects women in the workforce. Thus, any serious efforts to improve food security must address these factors as well.

This study suggests that food secure households did not experience significant changes to their diet, despite widespread disruptions to food systems during a global pandemic. Further research is needed to address how these food disruptions affected the diet quality and nutrition-related health outcomes of food insecure individuals with pre-existing chronic diseases. Continued research on the long-term effects of COVID-19 among the populations most vulnerable to food insecurity identified in this study is needed. Finally, as more nutrition assistance programs expand their services online, it would be worthwhile to investigate their usability and efficiency in closing food access gaps. This area of research could help nutrition assistance providers determine how to adjust their services to meet demand, especially in underserved communities.

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APPENDIX A: IRB Approval

SJSU SAN JOSÉ STATE UNIVERSITY
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SAN JOSE STATE UNIVERSITY
HUMAN SUBJECTS INSTITUTIONAL REVIEW BOARD

IRB Notice of Approval

Date of Approval: 7/28/2020

Study Title: Food Access in the Bay Area during COVID-19 Outbreak

Primary Investigator(s): Dr. Giselle Pignotti

Student(s): Iris Tablas-Mejia, Adriana Telias

Other SJSU Team Members:

Funding Source: None

IRB Protocol Tracking Number: 20162

Type of Review

☒ Exempt Registration: Category of approval §46.104(d)(2iii)
☐ Expedited Review: Category of approval §46.110(a)()
☐ Full Review
☐ Modifications
☐ Continuing Review

Special Conditions
☒ Waiver of signed consent approved
☐ Waiver of some or all elements of informed consent approved
☐ Risk determination for device:
☐ Other:

Continuing Review
☒ Is not required. Principal Investigator must file a status report with the Office of Research one year from the approval date on this notice to communicate whether the research activity is ongoing. Failure to file a status report will result in closure of the protocol and destruction of the protocol file after three years.

☐ Is required. An annual continuing review renewal application must be submitted to the Office

of Research one year from the approval date on this notice. No human subjects research can occur after this date without continuing review and approval.

Approved by Dr. Pamela C. Stacks
Associate Vice President
Institutional Official
Office of Research
San Jose State University

IRB Contact
Alena Filip
Human Protections Analyst
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Primary Investigator Responsibilities

- Any significant changes to the research must be submitted for review and approval prior to the implementation of the changes.
- Reports of unanticipated problems, injuries, or adverse events involving risks to participants must be submitted to the IRB within seven calendar days of the primary investigator's knowledge of the event.
- If the continuing review section of this notice indicates that continuing review is required, a request for continuing review must be submitted prior to the date the provided.

APPENDIX B: NFACT Bay Area Survey

Consent
Request for your participation in research
Welcome to the Food Access and COVID-19 research study!

Researchers
Giselle Pignotti, PhD, RD, associate professor; Marcelle Dougan, ScD, MPH, MEng, assistant professor; Iris Tablas-Mejia, graduate student; Adriana Telias, PhD, graduate student
Department of Nutrition, Food Science, and Packaging; San Jose State University

Purpose & Confidentiality
This study is being conducted to understand how the COVID-19 (coronavirus) outbreak affects food buying, food access, and eating behaviors. This information will be used to inform policymakers and COVID-19 responses as they relate to food security. Please be assured that your responses will be kept completely confidential. The results will be reported in aggregate form only and you will not be identified individually in any publication from this study.

Procedures & Your Rights
You will complete an online survey about food and eating behaviors. The survey should take you around 20 minutes to complete. Your participation in this research is voluntary. You have the right to withdraw at any point during the study, for any reason, and without any prejudice.

You will have the option to provide your email address in order to complete follow-up surveys to better understand how food and eating behaviors change over time in response to the COVID-19 pandemic. If you decide to provide your email, there would be a link between your responses and your email address. We will never share what you said with anyone else or report it in any identifiable way. We will always do everything we can to respect and protect your privacy.

Compensation
There is no compensation for taking this survey. At the end of the study, you have the option of providing your email address to be entered into a raffle to win one of ten $20 Amazon gift cards. The raffle will not be connected to your survey responses. Chance to win is approximately 1 in 400

Contact Information
If you would like to contact the Principal Investigator in the study to discuss this research, please e-mail giselle.pignotti@sjsu.edu. Research assistants Iris Tablas-Mejia (iris.tablasmejia@sjsu.edu) and Adriana Telias (adriana.telias@sjsu.edu)

Agreement to Participate
Please select from the choices below. If you click yes, it is implied that you have read the information above about the research, your rights as a participant, and give your voluntary consent. Please print out a copy of this page and keep it for your records.

- Yes. Continue with the survey.
- No. Exit.

Screener
To find out if you are eligible to take this survey, please answer the following questions:
Have you lived in the United States since at least January 1st, 2020?

- Yes
- No (Exit Survey)

Are you over 18 years of age?

- Yes
- No (Exit Survey)

Which Bay Area county do you live in?

- Please choose only one from the drop-down menu:
- Contra Costa County
- Marin County
- Napa County
- San Francisco County
- San Mateo County
- Santa Clara County
- Santa Cruz County
- Solano County
- Sonoma County
- I do not live in the Bay Area (Exit Survey)

General Food Access (part 1 of 6)
In this survey we will refer to "since the COVID-19 outbreak" in many questions. We are using March 11th as a start date for the COVID-19 outbreak. While it had been building for some time, that was the date the World Health Organization declared that the outbreak was a pandemic. When we ask about "the year before the COVID-19 outbreak," we mean March 11, 2019 to March 10, 2020.

1. **Which of the following places did your household use to get food in the last year and since the COVID-19 outbreak (March 11th)? Check all that apply.**

	In the year before the COVID-19 outbreak	Since the COVID-19 outbreak (March 11th)
***Store*: Grocery store, supermarket, large bulk stores**		
***Store*: Convenience store, corner store**		
***Store*: Specialty store (ethnic market, co-op, health food store)**		
***Delivery*: Grocery (like Amazon or Instacart)**		
***Delivery*: Meal-kit (like Blue Apron)**		
***Delivery*: Meals on Wheels**		
***Restaurant*: To go (delivery, take-out, curbside pickup, drive thru)**		
***Restaurant* or cafeteria - eat-in**		
Programs that give food (such as food pantry, school food)		
Meals served in group setting like senior center, church, or synagogue		
***Local*: Farmers' market**		
***Local*: Direct from farm: (Community Supported Agriculture (CSA), farm stand pickup / delivery)**		
***Local*: Garden, fishing, foraging, hunting, or using my own canned goods**		
Other (please specify below if selected)		

Enter any additional places you get food:

Only answer this question if Other is selected above:

2. **How true are these statements about your household's food situation in the last year before the COVID-19 and since the COVID-19 outbreak on March 11th?**

Please choose the appropriate response for each item:

	In the year before the COVID-19 outbreak				Since the COVID-19 outbreak (March 11th)			
	Often true	Sometimes true	Never true	I don't know	Often true	Sometimes true	Never true	I don't know
The food that my household bought just didn't last, and I/we didn't have money to get more								
I/we couldn't afford to eat balanced meals								

Please choose the appropriate response for each item:

	In the year before the COVID-19 outbreak			Since the COVID-19 outbreak (March 11th)		
	Yes	No	I don't know	Yes	No	I don't know
Did you or other adults in your household ever cut the size of your meals or skip meals because there wasn't enough money for food? (If yes, please indicate how often below)						
Did you ever eat less than you felt you should because there wasn't enough money for food?						
Were you ever hungry but didn't eat because there wasn't enough money for food?						

How often did you cut the size of your meals or skip meals?

Only answer this question if the following conditions are met:

-------- Scenario 1 --------
Answer was 'Yes' at question (Did you or other adults in your household ever cut the size of your meals or skip meals because there wasn't enough money for food? (If yes, please indicate how often below) Label In the last 12 months))

	In the year before the COVID-19 outbreak				Since the COVID-19 outbreak (March 1111th)			
	Almost every month	Some months but not every month	Only one or two months	I don't know	Once	Twice	Weekly	Daily
How often did this happen?								

3. **Which of the following food assistance programs did your household use in the past, if any, and since the COVID-19 outbreak (March 11)? Check all that apply (if none, leave blank).**

	Used in the year prior to COVID-19 outbreak	Used since the COVID-19 outbreak (since March 11th)
SNAP or Food Stamps (including pandemic-EBT or P-EBT)		
WIC (Women, Infant and Children's Program)		
School Meal Program (Lunch, Breakfast, or Summer meals)		
Food pantry/ Food bank		
Other food assistance program (Commodity Supplemental Food program, Meals on Wheels, or other)		

If "Other food assistance program": [fill in] _____

3a. Please indicate your level of agreement regarding **using SNAP** (or Food Stamp) food benefits **since the COVID-19 outbreak**? [*only shows up for respondents with yes for COVID-19 outbreak time participation*]

Since the COVID-19 outbreak:	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Overall, SNAP benefits are easy to use to buy food for our household					
SNAP benefits are enough to meet our household's needs					
We cannot use SNAP benefits to pay for groceries ordered online					
We are not able to use our full months' worth of SNAP benefits (because, for example, it is hard to go shopping or stores do not have food we need)					
Any other comments about using SNAP during the COVID-19 outbreak? (please specify)					

3b. Please indicate your level of agreement regarding **using WIC** benefits **since the COVID-19 outbreak.** [*only shows up for respondents with yes for COVID-19 outbreak time participation*]

Since the COVID-19 outbreak:	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Overall, WIC benefits are easy to use to buy food for our household					
There is a limited selection of food at the stores that we can buy with our WIC benefits					
We cannot use our full months' worth of WIC benefits (because, for example, it is hard to go shopping or stores are sold out of WIC items)					
If available, we would be interested in shopping for WIC foods online and using curbside pickup or delivery					
Any other comments about using WIC during the COVID-19 outbreak? (please specify)					

3c. Please indicate your level of agreement regarding **School Meals for children in your household since the COVID-19 outbreak**. These meals are offered at various school and community pick up locations and in some cases can be home delivered. [*only shows up for respondents with yes for COVID-19 outbreak time participation*]

Since the COVID-19 outbreak:	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Not applicable
The school meals are very helpful for my household						
School meal sites are not open on a consistent basis						
We do not have the kitchen equipment to safely store or reheat meals						
School meal delivery to our home is not available or is hard to arrange						
We are unable to pick up the meals at the time they are offered						
We are unable to pick up the meals at the place they are offered						
Sites provide meals for several days at one time and we run out of meals before the next pick up or delivery day						
The new Pandemic-EBT (P-EBT) card/benefits to pay for children's meals while school is out have been very helpful						
Any other comments about using school meals or Pandemic-EBT for school meals during COVID-19 outbreak? (please specify)						

3d. Please indicate your level of agreement regarding **using a food pantry/food bank during the COVID-19 outbreak**? [*only shows up for respondents with yes for COVID-19 outbreak time participation*]

During the COVID-19 outbreak:	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Food offered at the food pantry/food bank has been very helpful for my household					
The food pantry does not have food that my household likes to eat					
The food pantry does not have good quality food					
The food pantry gives me foods I do not know how to prepare					
The food pantry runs out of food often					
Food pantry hours are inconvenient or irregular					
There are long lines / long wait time					
There are limits on how often we can visit the food pantry close to our home					
Any other comments about using food pantries during COVID-19 outbreak (please specify)					

3e. Please indicate your level of agreement regarding **concerns and barriers to using income-based food programs and food pantries** since the COVID-19 outbreak (March 11th)?

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Not applicable
I am worried about the paperwork I need to share to enroll in food programs						
I do not want to rely on food programs because I value personal independence						
It is difficult for me to travel to the food program offices to apply and recertify						
I'm worried that I have too many personal assets (savings, house, car) to qualify for a food program						
I'm worried people will find out I use these programs						

4. **What were the typical types of transportation you used to get food for your household, in the last 12 months and since the COVID-19 outbreak? Check all that apply.**

	In the year before the COVID-19 outbreak	**Since the COVID-19 outbreak (March 11th)**
Bus or other public transit		
Own vehicle		
Ride from friend/family/neighbor		
Ride from taxi or app like Lyft/Uber		
Someone brings food to me (delivery service or friend/family member)		
Walk or bike		
Other (please specify below if selected)		

5. **How often did these happen to your household when getting food, since the COVID-19 outbreak (March 11th)?**

Please choose the best response for each item:

	Never	Sometimes	Usually	Every time	Not applicable
Could not find AS MUCH food as I wanted to buy (food not in store)					
Could not find THE TYPES of food my household prefers to eat					
Had challenges knowing where to find help for getting food					
Had to go to more places than usual to find the food my household wanted					
Had to stand too close to other people, when getting food (less than six feet away)					
Reduced grocery trips to avoid COVID-19 exposure					

Please describe the kinds of food you wanted and could not get, or the kinds of food you got and did not want:

Only answer this question if the following conditions are met:
Answer was 'Sometimes' *or* 'Usually' *or* 'Always' at (Could not find THE KINDS of food my household prefers to eat))
Please write your answer here:

If you had to stand too close to other people, what sort of place were you in? (such as store, food pantry, school food program, etc.)? Only answer this question if the following conditions are met:

Answer was 'Always' *or* 'Usually' *or* 'Sometimes' at question ' (Since the COVID-19 outbreak (March 11th), how often did these happen to your household? (Had to stand "too close for safety" to other people, when getting food (less than six feet away)))
Please write your answer here:

6. **Have you or anyone in your household experienced a loss of income or job since the COVID-19 outbreak (March 11th)? Check all that apply.**

	Happened at all since COVID-19 outbreak (March 11th)	Still happening today
Yes, lost job		
Yes, reduced hours or income at job		
Yes, furloughed		
No, have not had any changes in job		

7. Have you received any money from these sources since the COVID-19 outbreak? Check all that apply.

___ Federal stimulus check

___ Friends or family

___ Unemployment benefits

Food Access (part 2 of 6)

8. What, if anything, would help your household to meet its food needs during the COVID-19 pandemic?

Please choose the appropriate response for each item:

	Not helpful	Helpful	Not applicable
Access to public transit or rides			
Different hours in meal programs or stores			
Extra money to help pay for food or bills			
Information about food assistance programs			
More (or different) food in stores			
More trust in the safety of food			
More trust in safety of food delivery			
More trust in safety of going to stores			
Support for the cost of food delivery			
Other (please specify below if selected)			

Enter other things that would make it easier for your household to meet its food needs during the COVID-19 pandemic:

Only answer this question if the following conditions are met:
Answer was 'Helpful' at question 'What, if anything, would make it easier for your household to meet its food needs during the COVID-19 pandemic? (Other (please specify below if selected)))
Please write your answer here:

How much extra money per week is needed to meet your household's food needs? Please provide your best estimate.

Only answer this question if the following conditions are met:
Answer was 'Helpful' at question (What, if anything, would make it easier for your household to meet its food needs during the COVID-19 pandemic? (Extra money to help pay for food or bills))
Please write your answer here: (numerical only or short answer)

9. On a scale from 1 (not at all worried) to 6 (extremely worried), what is your level of worry for your household about the following as it relates to COVID-19:

Please choose the appropriate response for each item:

	1 (not at all worried)	2	3	4	5	6 (very worried)	Not applicable
There will not be enough food in the store							
The country will not have enough food to feed everyone							
Food will become more expensive for my household							
Food will become unsafe or contaminated							
My household will not be able to get or will lose access to programs that provide free food or money for food							
My household will lose so much income that we can't afford enough food							
My household won't have enough food if we have to stay at home and can't go out at all (due to quarantine or illness)							

Please describe any other worries you have about food and COVID-19:

Please write your answer here:

10. Which of the following strategies, if any, are you using now to afford food? If not using them now, how likely are you to use these if your household has challenges affording food in the future during the COVID-19?

Please choose the appropriate response for each item:

	Using now	Would use if needed in the future during COVID-19					
	Yes	Very unlikely	Unlikely	Somewhat unlikely	Somewhat likely	Likely	Very likely
Accept food from friends or family							
Borrow money from friends or family							
Buy different, cheaper foods							
Buy food on credit							
Buy foods that don't go bad quickly (like pasta, beans, rice, canned foods)							
Get food from a food pantry or soup kitchen							
Stretch the food that I have by eating less							
Rely more on hunting/fishing/foraging/growing my own food							
Other (please specify below if selected)							

Enter other strategies your household is currently using or might use in the future:

Only answer this question if the following conditions are met:

-------- Scenario 1 --------
Answer was 'Very unlikely' at question 10 (Which of the following strategies, if any, are you currently using or likely to use in the future during the COVID-19 if your household has challenges affording food? Indicate both current use where applicable and future use. (Other (please specify below if selected) Label Currently using))

	Currently using:	May use in the future:
Other:		

Eating and Purchasing Behaviors (part 3 of 6)

11. Do you or someone in your household have a special diet?

Please choose **all** that apply:

- Food allergy that requires avoiding some foods (such as nut, wheat, dairy allergy)
- Food sensitivity that causes problems from eating some foods (such as gluten free or dairy intolerance)
- Need to avoid some foods for health condition like diabetes or kidney disease
- Religious restriction (such as kosher, halal)
- Vegetarian, vegan
- Weight loss diet that requires special foods
- Other:

11a. Have you had challenges finding food that meets these food needs since the COVID-19 outbreak (March 11th)? (conditional only if yes to above)

	Yes	No	Not applicable
Which special food need? (carry from above)			
Which special food need? (carry from above)			
Which special food need? (carry from above)			

12. The next questions are about how you have been eating <u>in the past month during the COVID-19 outbreak (since March 11th).</u>

About how many cups of fruit (including 100% pure fruit juice) do you eat or drink each day? Examples of 1 cup for fruit include 1 small apple, 1 large banana, 1 cup (8 oz.) of 100% juice or canned fruit, or ½ cup of dried fruit.	• None • ½ cup or less • ½ to 1 cup • 1–2 cups • 2–3 cups • 3–4 cups • 4 cups or more
About how many cups of vegetables (including 100% vegetable juice) do you eat or drink each day? Examples of 1 cup of vegetables include 1 cup of cooked leafy greens, 2 cups of lettuce or raw greens, 12 baby carrots, 1 medium potato, or 1 large raw tomato.	• None • ½ cup or less • ½ to 1 cup • 1–2 cups • 2–3 cups • 3–4 cups • 4 cups or more

How often did you eat red meat (such as beef, pork, ham, sausage, veal lamb)? Do not include chicken, turkey or seafood. Include red meat you had in sandwiches, lasagna, stew, and other mixtures.	• Never • 1 time last month • 2--3 times last month • 1 time per week • 2 times per week • 3--4 times per week • 5--6 times per week • 1 time per day • 2 or more times per day
How often did you eat any processed meat, such as bacon, lunch meats, or hot dogs? Include processed meats you had in sandwiches, soups, pizza, casseroles, and other mixtures. Processed meats are those preserved by smoking, curing, or salting, or by the addition of preservatives.	• Never • 1 time last month • 2--3 times last month • 1 time per week • 2 times per week • 3--4 times per week • 5--6 times per week • 1 time per day • 2 or more times per day
How often did you eat any sugary snacks (such as cookies, chocolate, candy, ice cream, pastries)? Include homemade and ready-to-eat items.	• Never • 1 time last month • 2--3 times last month • 1 time per week • 2 times per week • 3--4 times per week • 5--6 times per week • 1 time per day • 2 or more times per day
How often did you eat any salty snacks (such as chips, crackers, pretzels)? Do not include unsalted popcorn and nuts.	• Never • 1 time last month • 2--3 times last month • 1 time per week • 2 times per week • 3--4 times per week • 5--6 times per week • 1 time per day • 2 or more times per day
How often did you drink any alcoholic beverages (wine, beer, or spirits such as vodka, tequila, rum)? Include mixed drinks such as Irish Coffee, Margarita, Moscow Mule, and Mimosas.	• Never • 1 time last month • 2--3 times last month • 1 time per week • 2 times per week • 3--4 times per week • 5--6 times per week • 1 time per day • 2 or more times per day

12a. Compared to before the COVID-19 outbreak, how have you been eating <u>in the past month during the COVID-19 outbreak (since March 11th).</u>

	More	Less	Same
I have been eating more, less, or about the same amount of fruits and vegetables per day.			
I have been eating more, less, or about the same amount of processed and red meats.			
I have been eating more, less, or about the same amount of fish and seafood.			
I have been eating more, less, or about the same amount of sugary snacks			
I have been eating more, less, or about the same amount of salty snacks			
I have been drinking more, less, or about the same amount of alcoholic beverages			

13. Please indicate your level of agreement with the following statements regarding eating during the COVID-19 outbreak (since March 11th)

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
I find myself eating when I'm feeling emotional (such as anxious, depressed, sad), even when I'm not physically hungry.					
I find myself eating when I am lonely, even when I'm not physically hungry.					
I find myself eating when I am stressed out, even when I'm not physically hungry.					
I find myself eating when I am bored or restless, even when I'm not physically hungry.					
I find myself eating when I am angry or frustrated, even when I am not physically hungry.					
I am able to cope with my negative emotions (such as anxiety, sadness, anger and boredom) without turning to food for comfort.					

14. Please indicate whether any of the following is true about your eating and shopping behaviors in the year before the COVID-19 outbreak and since the COVID-19 outbreak (March 11th):

Behavior	In the year before the COVID-19 outbreak	Since the COVID-19 outbreak (March 11th).
I choose local products	Always true, often true, sometimes true, never true, don't know	Always true, often true, sometimes true, never true, don't know
I buy products with low packaging	Always true, often true, sometimes true, never true, don't know	Always true, often true, sometimes true, never true, don't know
I use reusable shopping bags	Always true, often true, sometimes true, never true, don't know	Always true, often true, sometimes true, never true, don't know
I choose a vegetarian meal over a meat-based dish	Always true, often true, sometimes true, never true, don't know	Always true, often true, sometimes true, never true, don't know
I choose animal products with sustainability labels (such as pasture raised or grass-fed meats, or cage-free eggs)	Always true, often true, sometimes true, never true, don't know	Always true, often true, sometimes true, never true, don't know

15. Has your household done any of the following since the COVID-19 outbreak (March 11th)? Do you believe the average U.S. household has done them, since that time? Check all that apply.

	My household has done this	I believe the average U.S. household has done this
Buy a lot more items in a single trip than before the outbreak (such as 50% more than my household needs)		
Deliver food to a friend, neighbor, or family member		
Donate to others or share		
Keep normal shopping habits		
Maintain a two week supply of food for my household in case we become ill or got quarantined		
Social distanced by not seeing friends in person		
Spend more time cooking		
Throw away less food than normal		
Throw away more food than normal because of extra buying		
Volunteer related to the COVID-19 outbreak		
Wear a mask in public		

Risk Factors (part 4 of 6)

30. Do you have any of the following? (Please check all that apply)

- None- I do not have any of these health conditions
- Asthma (moderate to severe)
- Cancer
- Chronic obstructive pulmonary disease (COPD) such as emphysema and chronic bronchitis
- Chronic kidney disease
- Chronic liver disease such as cirrhosis
- High blood pressure
- Neurologic conditions, such as dementia
- Other chronic lung diseases such as pulmonary fibrosis and cystic fibrosis
- Serious heart condition such as heart failure, coronary artery disease, or cardiomyopathies
- Type 1 Diabetes
- Type 2 Diabetes
- Other disease that might compromise your immune system

31. How would you describe your general health?

- Excellent
- Very Good
- Good
- Fair
- Poor
- I don't know

32. How much do you weigh? (in pounds) _____

33. How tall are you? Feet _____ Inches _____

34. Compared to before the COVID-19 outbreak (before March 11), which of the following statements best describes your weight

- My weight stayed more or less the same
- My weight decreased
- My weight increased

35. In the past month, on average how many hours of sleep did you get in 24 hours? (approximately)

- 3 hours or less
- 4 hours
- 5 hours
- 6 hours
- 7 hours
- 8 hours
- 9 hours
- More than 9 hours

36. In the past month, how many hours a week did you usually spend doing the following activities:

Moderate physical activity that made you breathe somewhat harder than normal	• 0 hours per week • 1 hour per week • 2 hours per week • 3 hours per week • 4 hours per week • 5 hours per week • 6 hours per week • 7 or more hours per week
Vigorous physical activity that made you breathe much harder than normal	• 0 hours per week • 1 hour per week • 2 hours per week • 3 hours per week • 4 hours per week • 5 hours per week • 6 hours per week • 7 or more hours per week

37. Regarding cigarette smoking, which of the following applies to you?

- I currently smoke regularly
- I currently smoke occasionally
- I used to smoke but I stopped
- I have never smoked

38. Compared to before the COVID-19 outbreak (before March 11), how have these lifestyle habits been in the past month during the COVID-19 outbreak.

	More	Less	Same
I have been sleeping, more, less, or about the same amount per day			
I have been exercising more, less, or about the same amount per week			
I have been smoking more, less, or about the same amount per day			

Perspectives and Experience (part 5 of 6)

16. On a scale from 1 (strongly disagree) to 6 (strongly agree), how much do you agree with the following statements:

Please choose the appropriate response for each item:

	1 (strongly disagree)	2	3	4	5	6 (strongly agree)	I don't know
The current COVID-19 outbreak is just like the seasonal flu							
COVID-19 will affect other states more than mine							
COVID-19 will affect other countries more than the United States							
COVID-19 will affect people like me							
The US should prioritize the economy over public health when it comes to COVID-19							
Average people should stay at home as much as possible to prevent the spread of COVID-19							
Food is not a source of COVID-19							
I felt prepared for the COVID-19 outbreak							
Touching food packages can't transmit COVID-19							
It is worth the health risk to reopen the economy as soon as possible							
It is worth the health risk to maintain the food supply such as requiring farms and food processing plants to stay open, because we need food.							
If grocery or food delivery workers went on strike, I would take action to support them (like shop elsewhere, sign a petition, contribute money)							

17. Do you know anyone with symptoms of, or diagnosed with, COVID-19? (If so, who? Check all that apply.

Please choose **all** that apply:

- Yes, family
- Yes, friend(s)
- Yes, myself
- Yes, other
- No, I don't know anyone

18. Have you had to quarantine in your home due to COVID-19 (for example because of illness, exposure or symptoms)?

- Yes
- No

Demographics (part 6 of 6)

19. How many people in the following age groups currently live in your household (household defined as those currently living within your household, including family and non-family members)?

Please choose the appropriate response for each item:

	0	1	2	3	4	5	6	7+
Adults over 65:								
Adults 18-65:								
Children 5-17:								
Children under 5								

20. Which of the following best describes your current occupation?

Choose one of the following answers
Please choose **only one** of the following:

- Agriculture, Forestry, Fishing and Hunting
- Arts, Entertainment, and Recreation
- Broadcasting and Media
- Childcare Provider
- Clerical/Administrative
- College, University, and Adult Education
- Computer and Electronics Manufacturing
- Construction
- Disabled and on Disability Benefits

- Finance and Insurance
- Food and Beverage Services
- Government and Public Administration
- Health Care and Social Assistance
- Homemaker
- Hotel and Hospitality Services
- Information Services and Data Processing
- Legal Services
- Military
- Mining
- Other Information Industry
- Other Manufacturing
- Primary/Secondary (K-12) Education
- Publishing
- Real Estate, Rental, and Leasing
- Religious
- Retail
- Retired
- Scientific or Technical Services
- Self-employed
- Software
- Student
- Telecommunications
- Transportation and Warehousing
- Unemployed
- Utilities
- Other

21. What is your zip code?

Please write your answer here:

22. In what year were you born?

Please write your answer here:

23. Which of the following best describes your gender identity?

Choose one of the following answers
Please choose **only one** of the following:

- Male
- Female
- Transgender
- Non-binary
- Prefer to self-describe

24. Are you of Hispanic, Latino, or Spanish origin?

Choose one of the following answers
Please choose **only one** of the following:

- No, not of Hispanic, Latino, or Spanish origin
- Yes, Mexican, Mexican American, Chicano
- Yes, Puerto Rican
- Yes, Cuban
- Yes, another Hispanic, Latino, or Spanish origin:

25. What is your race? Check all that apply:

Check all that apply
Please choose **all** that apply:

- American Indian or Alaskan Native
- Asian Indian
- Black or African American
- Chamorro
- Chinese
- Filipino
- Japanese
- Korean
- Native Hawaiian
- Samoan
- Vietnamese
- White
- Other race or origin

26. What is the highest level of formal education that you have completed?

Choose one of the following answers
Please choose **only one** of the following:

- Some high school (no diploma)
- High school graduate (incl. GED)
- Some college (no degree)
- Associates degree/technical school/apprenticeship
- Bachelor's degree
- Postgraduate (like Master's, PhD) / professional degree (like JD)

27. Which of the following best describes your household income range in 2019 before taxes?

Choose one of the following answers
Please choose **only one** of the following:

- Less than $10,000
- $10,000 to $14,999
- $15,000 to $24,999
- $25,000 to $34,999
- $35,000 to $49,999
- $50,000 to $74,999
- $75,000 to $99,999
- $100,000 to $149,999
- $150,000 to $199,999
- $200,000 or more

28. Which of the following political affiliations do you most identify with?

Choose one of the following answers
Please choose **only one** of the following:

- Democrat
- Green Party
- Independent
- Libertarian
- No affiliation
- Progressive
- Republican
- Other

29. Do you have any additional comments or experiences related to the issue of food during the COVID-19 outbreak that you would like to share? Please use this space:

Please write your answer here:

Optional: Contact and Raffle

39. To better understand how food and eating behaviors change over time in response to the COVID-19 pandemic, we are asking for your email in order to complete future surveys and an online dietary intake assessment. You will be provided access to a website to enter your dietary intake and you can view a nutrition report about how your intake compares to dietary guidelines. This is completely optional. If you are willing to complete follow-up surveys, please provide your email address

- Yes, email:
- No

40. Are you interested in entering a raffle for the chance to win one of ten $20 Amazon gift cards? Please note that answering yes, will redirect you to a separate survey so you can provide your email address. The raffle will not be connected to your survey responses.

- Yes
- No

Thank you for completing this survey.

Following are some resources for support in getting food and for mental health and other services. If you think you may have symptoms of COVID-19, please go to the CDC's Coronavirus (COVID-19) Self-Checker for advice about options.

Food

- USDA National Hunger Hotline, 1-866-3-HUNGRY (1-866-348-6479) or 1-877-8-HAMBRE (1-877-842-6273). English/Spanish, M-F, 7am-10pm Eastern time.
- Find your local food bank online
- Find out about government food assistance programs like SNAP (food stamps) and WIC: contact your state via links at this site:

Mental health

- If you need crisis counseling and support related to the COVID-19, call the Disaster Distress Helpline (1-800-985-5990) or text TalkWithUs to 66746.
- The Centers for Disease Control has a lot of other resources and information about dealing with stress from the COVID-19 and from related issues.

Other services

- United Way's 211 phone service is a one-stop-shop for information about many local services including food and health care. Call 211. http://211.org/