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EXPERIENCES PARTICIPATING IN FEDERAL NUTRITION ASSISTANCE
PROGRAMS DURING THE EARLY MONTHS OF THE COVID-19 PANDEMIC: A
MIXED METHODS STUDY IN VERMONT

A Thesis Presented

by

Emma Spence

to

The Faculty of the Graduate College

of

The University of Vermont

In Partial Fulfillment of the Requirements
for the Degree of Master of Science
Specializing in Food Systems

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ABSTRACT

For many Americans, the impacts of the COVID-19 pandemic have extended far beyond its overt health risks, spanning from economic shocks to new social realities. Elevated rates of both novel and continued food insecurity during the pandemic have been well-documented, and this burden has not been equally shared. Examination of food insecurity at the present moment offers a unique opportunity to give voice to those affected during this unprecedented time and understand the ability of existing social services to meet increased needs. This research aims to delve into the experiences of individuals at risk for food insecurity. Specifically, (1) to understand experiences and challenges in utilizing federal nutrition assistance programs among participants during the early months of the COVID-19 pandemic, and (2) to examine associations of program participation with food insecurity, fruit and vegetable intake, and perceived stress.

Data for each of these endeavors is drawn from of a survey of 600 Vermont residents conducted in August and September of 2020 designed to assess food security. Although we do not find reduced rates of food insecurity or increased fruit and vegetable intake among federal nutrition assistance program participants, our data suggest that these programs were able to reach those most in need of their services during the tumultuous early months of the COVID-19 pandemic. We also find that program participants perceive value in these programs. Alleviating the experience of food insecurity is a complex task that requires consistent reflection and reexamination of the tools at our disposal particularly under conditions of elevated strain.

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CHAPTER 1: LITERATURE REVIEW

1.1. Food Insecurity during the COVID-19 Pandemic

Food insecurity, or “access by all people at all times to enough food for an active, healthy life” (USDA, 2022), is a perpetual challenge for many Americans, and is associated with numerous negative physical and mental health outcomes (Bruening, Dinour & Chavez, 2017; Gunderson & Seligman, 2017). In 2020 – the first year of the COVID-19 pandemic, 10.5% of American households experienced food insecurity at some point during the year, remaining consistent with rates in 2019 after a decline in prevalence since a peak of 14.9% in 2011 (Coleman-Jensen et al., 2021). However, households with children experienced a rise in food insecurity during the COVID-19 pandemic, from 13.6% in 2019 to 14.8% in 2020 (Hale & Coleman-Jensen, 2022). Additionally, food insecurity is disproportionately experienced by low-income households, adults living alone and Black and Hispanic-headed households (Coleman-Jensen et al., 2021). The US Department of Agriculture (USDA) has developed standardized tools for assessing food security through a series of questions probing experiences and behaviors including the inability to afford balanced meals, cutting meal sizes or skipping meals, and going hungry (Coleman-Jensen et al., 2021).

Although rates of food insecurity in the US have trended downwards over the last several years, the COVID-19 pandemic brought with it new and continued challenges in food access for many (Morales, Morales & Beltran, 2020; Niles et al., 2020; Wolfson & Leung, 2020). For example, job loss or the inability to work due to the pandemic were significant risk factors for household food insecurity during this time (Coleman-Jensen et

al., 2021). This thesis explores the experiences of individuals at risk for food insecurity during the COVID-19 pandemic, specifically by examining the perspectives of federal nutrition program participants in engaging with these social support programs during the early months of the pandemic.

1.2. Federal Nutrition Assistance Programs

The federal government provides 15 nutrition assistance programs administered by the Food and Nutrition Service of the USDA, whose overarching mission is, “to increase food security and reduce hunger by providing children and low-income people access to food, a healthful diet and nutrition education” (USDA FNS, 2022). Of these programs, the three largest are the Supplemental Nutrition Assistance Program (SNAP), the Special Supplemental Nutrition Program for Women, Infants and Children (WIC) and the National School Lunch Program, which collectively served an estimated 55% of food insecure households in 2020 (Coleman-Jensen et al., 2021). In response to the COVID-19 pandemic, the USDA introduced multiple waivers and program flexibilities intended to adapt the programs to changing conditions (USDA, 2021). With social distancing measures, closures and mandates raising new barriers to safe in-person grocery shopping, programs explored the possibilities of expanded online benefit redemption options (USDA, 2021). Prior qualitative studies have explored the relative merits of online options under pre-pandemic conditions, reporting perceived advantages including convenience, time savings, and the ability to address transportation barriers (Jilcott Pitts et al., 2020; Lagisetty et al., 2017; Zimmer et al., 2020b, 2020a), although financial concerns such as additional fees and fewer deals and lack of control over item selection

and quality were negative factors for some participants (Jilcott Pitts et al., 2020; Martinez et al., 2018; Rogus et al., 2020).

Other notable program adaptations included measures to deliver nutrition programs to eligible children despite school closures. These included a set of waivers on required mealtimes and settings designed to allow parents and guardians to bring school meals home for their children when schools were not in session (USDA, 2021).

Additionally, temporary emergency nutrition benefits in the form of Pandemic Electronic Benefits Transfer (P-EBT) cards were available to families of children who would normally have received free or reduced-price meals or SNAP-eligible children affected by school and childcare closures (USDA, 2021). Other waivers were designed to temporarily increase benefits to participants and investment in programs (USDA, 2021).

Evaluating the efficacy of these programs and temporary measures depends on both quantifiable outcomes and a focused exploration of the experiences and perspectives of participants, which can yield significant insights into the successes and limitations of each program.

CHAPTER 2: EXPERIENCES PARTICIPATING IN FEDERAL NUTRITION ASSISTANCE PROGRAMS DURING THE EARLY MONTHS OF THE COVID-19 PANDEMIC: A MIXED METHODS STUDY IN VERMONT

2.1. Abstract

2.1.1. Background

Federal nutrition assistance programs serve as safety nets for many American households, and participation has been linked to increased food security and, in some instances, improved diet quality and mental health outcomes. The COVID-19 pandemic brought new and increased economic, social, and psychological challenges, necessitating inquiry into how nutrition assistance programs are functioning and associated public health outcomes.

2.1.2. Methods

Using data from a representative statewide survey administered in Vermont (n=600) during the early months of the COVID-19 pandemic, we examine participant experiences with the three major federal nutrition assistance programs: the Supplemental Nutrition Assistance Program (SNAP), the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), and school meal programs. We explore quantitative and qualitative responses regarding perceptions of program utility, and use nearest neighbors matching analyses in combination with bivariate statistical tests to assess associations between program participation and food insecurity, perceived stress, and fruit and vegetable intake as indicators of dietary quality.

2.1.3. Results

One in four respondents (27.3%) used at least one federal nutrition assistance program. As compared to non-participants, we find higher rates of food insecurity among program participants (57.5% vs. 18.1%; $p < 0.001$), an association that persists even when we compare similar households using matching techniques ($p \leq 0.001$). From matched analyses, we find that, compared to low-income non-participants, low-income program participants are less likely to meet fruit intake recommendations ($p = 0.048$) and that low-income SNAP and WIC participants are less likely to meet vegetable intake recommendations ($p = 0.035$). We also find lower rates of perceived stress among low-income school meal participant households compared to low-income nonparticipants ($p = 0.039$). Despite these mixed outcomes, participants broadly valued federal nutrition assistance programs, characterizing them as helpful or easy to use.

2.1.4. Conclusions

Although we do not find reduced rates of food insecurity or increased fruit and vegetable intake among federal nutrition assistance program participants, our data suggest that these programs were able to reach those most in need of their services during the tumultuous early months of the COVID-19 pandemic. Additionally, participants perceived benefits from participation in these programs. Optimizing the utility of nutrition assistance programs depends on critical examination of their functioning under conditions of great stress.

2.2. Background

Collectively, the three major federal nutrition assistance programs in the United States impact tens of millions of Americans annually (1). The Supplemental Nutrition Assistance Program (SNAP) alone provided benefits to 41.2 million people in 2020, many of whom also participated in free and reduced-price school meals. While only about 7 million Americans participated in the Special Supplemental Nutrition Assistance Program for Women, Infants and Children (WIC) in 2020 (2), roughly half of all babies born in the US are a part of WIC (3). Collectively, these programs have been credited as essential safety nets in ensuring adequate nutrition for many who live at the margins of hunger and food insecurity.

Due to the urgent and persistent nature of the COVID-19 pandemic, there is a continuing need for research on the broader impacts of the pandemic on food and nutrition security. The objectives of this study are to describe demographic characteristics of low-income Vermonters who did and did not participate in federal nutrition assistance programs, and to understand the specific experiences of SNAP, WIC and school meal participants during the early months of the COVID-19 pandemic in Vermont, including relative ease of interacting with the program and perceptions of benefit adequacy to meet household needs during the pandemic. We also examine potential outcomes of program participation, including food security, fruit and vegetable intake, and perceived stress, with a focus on low-income Vermonters who participate in federal nutrition assistance programs. An in-depth understanding of the challenges faced in this novel social environment is needed to guide efforts to adapt nutrition support systems to better meet

the needs of vulnerable individuals during this ongoing crisis and future crises. The following paragraphs review the literature relevant to these topics.

2.2.1. Federal Nutrition Assistance Programs, Food Security, Diet Quality and Mental Health

It is difficult to assess a causal relationship between federal nutrition assistance programs and food security status, largely since households experiencing food insecurity are significantly more likely to participate in programs. In 2019, roughly “58% of food-insecure households participated in one or more of the three largest federal nutrition assistance programs” (4). However, studies attempting to control for selection bias suggest that SNAP participation may reduce the prevalence of food insecurity by as much as 30%, although specific estimates vary (5–8). In a program evaluation based on the SNAP Food Security survey of 9,811 households, Mabli et al. (7) found that SNAP participation among those enrolled for 6 months was associated with a 7% reduction in household food insecurity as compared to new enrollees, and a 16% reduction for those same new enrollees evaluated again after 6 months. Similarly, reductions in very low food security were 14% and 18%, respectively. Greater benefit allotments were associated with more significant improvements in food security status (7). However, Leung et al. (9) found no significant improvements in household food security over a 3-month period in a sample of 107 newly enrolled SNAP participants, suggesting that duration of enrollment may be relevant. Likewise, the SNAP benefit cycle may correspond to fluctuations in food security status. In a study of 1184 households, Gregory and Smith (10) found the probability of being food insecure to increase by 11% for

households in the last several days of the benefit cycle through the first several days of the next.

Both WIC and School Meal participation have likewise been associated with significant food security benefits for children (11–15). Metallinos-Katsaras et al. (12) analyzed longitudinal data collected from 21,863 WIC households and found that reduction in food insecurity was mediated by earlier program entry and longer duration of participation. In a nationally representative study, public-school children from food insecure households obtained a larger proportion of their total daily calories and nutrients from school meals as compared to children from highly food secure households (13). Cullen and Chen (14) found that among 448 children ages 5-18 who consumed both school breakfast and lunches, the two meals provided 47% of daily energy intake. Based on higher reported rates of food insecurity during the summer months among 15,241 households with children receiving free and reduced-price lunch, Huang and Barnidge (15) suggest that National School Lunch Program participation may be associated with a reduction in food insecurity of roughly 14%.

The findings of studies into associations between federal nutrition assistance programs and dietary quality may depend on the program. In a systematic review of 25 studies examining diet, Andreyeva, Tripp and Schwartz (16) found that overall caloric, macro and micronutrient intakes were not significantly different between SNAP participants and income eligible nonparticipants. Results of specific studies on dietary quality are mixed, with some finding that SNAP participants had poorer overall diet quality than both income-eligible and higher income nonparticipants (16–19), while

others have found improvements in dietary quality among SNAP eligible respondents who used the program (20). Focusing on fruit and vegetable intake, Saxe-Custack et al. (21) recently found that although SNAP participation did not increase the probability of participants meeting USDA intake recommendations, it did significantly increase the mean daily consumption of both fruits and vegetables for a cohort of child participants. Others have shown that trends in fruit and vegetable purchasing among SNAP households vary significantly according to the benefit cycle, although they are similar on average to non-participant households (22). Evidence suggests that specific incentive programs for SNAP participants, including Double-Up Food Bucks and other targeted fruit and vegetable purchasing incentives, may increase intake more than SNAP alone (23,24).

Studies suggest that WIC participation is significantly associated with improved diet quality in children (25,26). In an analysis of 1250 children enrolled in WIC, Weinfield et al. (26) also found that longer duration of program participation was associated with significantly higher Healthy Eating Index (HEI) scores as compared to eligible candidates who discontinued participation after infancy. A systematic review by Zhang et al. (27) also shows consistent, although not universal, positive correlations between fruit and vegetable purchasing and/or consumption by WIC participants since the 2009 program revision. Participation in daily school breakfast and lunch was associated with modestly healthier dietary intakes among 5,106 US school children, ages 4-15 (28). In a study of 3944 fourth and fifth graders, school lunch eaters had higher

average HEI scores than those who ate lunch brought from home, although this trend did not hold for school breakfast participants (29).

Food insecurity has been associated with multiple indicators of poor mental health (30–32). In a systematic review of 12 studies, Breuning et al. (30) identify a bidirectional relationship between food insecurity and negative emotional health in US-based populations. Myers et al. (32) likewise report significant positive associations between food insecurity and multiple measures of psychological distress based on an assortment of cross-sectional, longitudinal and secondary data studies in numerous countries. Focusing on high-income countries, Maynard et al. (31) find associations between food insecurity and mental health metrics, including symptoms of depression, anxiety and stress, among women in a review of 39 studies. Even more recently, using cross-sectional data from the 2020 U.S. Census Household Pulse Survey (N=63,674), Nagata et al. (33) report independent associations between food insufficiency and all measured indicators of poor mental health, controlling for sociodemographic covariates. Interestingly, they find that this association was mitigated by receipt of free groceries and meals (33). Additionally, a separate analysis of the dataset used in the present study shows a complex relationship between stress and home food procurement activities, with gardening associated with stress reduction while fishing, hunting and canning are associated with higher stress (34).

Several studies have attempted to examine how nutrition assistance programs may mediate relationships between food insecurity and various measures of mental health. Pulling data from the 2011-12 longitudinal SNAP Food Security Survey, Oddo and Mabli

(35) find that, among 3,146 U.S. households, 7.9% fewer household heads reported symptoms of psychological distress after 6 months of SNAP participation, and adjusted models show an associated decrease in psychological distress. Leung et al. (36) also examine the association between food insecurity and depression, as evaluated in the 2005-2010 NHANES dataset, restricted to adults earning no more than 130% of the federal poverty level. Controlling for sociodemographic and health covariates, they find a significant positive association between food insecurity and depression, but SNAP participation lessened the strength of this relationship. However, Adynski et al. (37) found that, controlling for demographic variables, SNAP and WIC participation did not reduce the risk of depressive symptoms in a nationally representative sample from the NHANES 2013-14 and 2015-16 cohorts, while elevated levels of food insecurity were associated with higher risks of depressive symptoms.

2.2.2. Program Participation and Value Assignment

2.2.2.1. SNAP

Despite established benefits, not all eligible participants take advantage of federal nutrition assistance programs. Demographic trends in participation vary between programs, although there is significant overlap between programs. In nationally representative studies, SNAP participants are more likely to be female (38), and tend to be younger than eligible nonparticipants (39). As of 2018, a significant majority (81%) of SNAP households contained at least one child, elderly individual, or individual with a disability, and 61% of those with children were single-adult households (38). Additionally, 81% of SNAP households lived in poverty (38). Monthly SNAP

participation has fluctuated significantly since the program's origin, peaking at 15.2% of residents nationwide in 2013 after the Great Recession and subsequently declining (40). Notably, early findings suggest that nationally, among households with children, participation in SNAP declined in the early months of the pandemic, whereas participation in WIC increased slightly and school meal participation remained consistent (41)

Program administration challenges, including failures in customer service and difficulties navigating administrative bureaucracy are common complaints, specifically during the application and renewal processes (42). Some SNAP participants have expressed concerns over benefit adequacy (42–44). In a series of mixed methods studies by Leung et al. (42,44), SNAP beneficiaries expressed strong support for increasing total SNAP benefit allotment (84.2-89%), as well as a preference for broadening benefits to include household essentials, and a reduction in eligibility requirements (42,44). Despite recommendations for improvement, SNAP participants felt overall that the program fulfilled its essential function of providing enough supplemental food to make ends meet, that the electronic benefits transfer (EBT) card format was easy to use, and that benefits were dependable (42).

2.2.2.2. *WIC*

In contrast to fluctuations in SNAP participation, WIC enrollment has been relatively stable, with rates roughly reflecting broader sociodemographic trends (45). However, there is significant variability in the duration of WIC enrollment, with characteristics such as lower household income increasing the probability of sustained enrollment (46)

and factors such as breastfeeding and home ownership associated with lower intent to maintain enrollment (47). Overall estimates of WIC-eligible nonparticipation rates range as high as 50% (48). In a population-based randomized survey of 1,634 postpartum women in New York City, WIC-eligible mothers facing structural barriers such as lack of transportation, unplanned pregnancy, and limited social supports were less likely to participate in WIC (49).

Insights from various qualitative studies indicate multiple other factors that influence program value assignment. Themes include: (1) logistical challenges in meeting time and transportation demands; (2) program administration challenges, including failures in communication and organization, as well as variable flexibility and amicability from program staff; and (3) challenges in the retail environment, including inconsistency and/or difficulty identifying eligible foods, lack of choice, lack of training of store employees, and perceptions of stigma (43,48,50–53).

Perceptions of and value placed on federal nutrition assistance programs by participants influence not only initial program participation, but intent to maintain enrollment despite sometimes stringent requirements. In a mixed-methods study of 150 WIC caregivers in Illinois (51), participants assessed perceived value of program packages at each stage of the program (pregnancy, infancy, childhood) against the time and effort required to maintain eligibility. During pregnancy and infancy, most participants believed benefits to be worth the time and effort (70%; 91%), hypothesized to be a function of the high cost of formula. However, only 36% believed the child program package value to be worth the effort once past reliance on formula. Additionally,

the more restrictive selection options under WIC may make WIC more difficult and stigmatizing to use than SNAP but are viewed by some as a useful incentive to eat more healthfully (50,51).

2.2.2.3. School Meals

School meal participation is highest among children eligible for free meals, and especially where universal free meals are offered (54,55). Rates of school breakfast participation are significantly lower than for lunch (56). Nontraditional breakfast formats, including meals served in classrooms after the start of the day and grab and go options, have been shown to promote participation (54,55). The implementation of the Healthy Hunger Free Kids Act in 2010 has not been associated with significantly altered rates of school lunch participation (57,58).

Multiple studies suggest that parental and student perceptions of school meals are significantly associated with program participation (59–61). Perceived healthfulness of meals by parents was associated with approximately 3.8 times greater meal participation rates in a survey of New Jersey households with children aged 7-18, and a significant majority viewed school lunch as healthy (59). In contrast, in a mixed methods survey of 488 school parents in Utah perceptions of healthfulness were mixed, with only 40% expressing the belief that the school breakfasts were healthy, and 45% unsure (62). Likewise, student perceptions of school meal healthfulness were associated with higher rates of participation in a cohort of 5,106 students from 130 US communities, although these perceptions did not correlate with objective measures of healthfulness (61). Sociocultural preferences and logistical challenges have also been shown to affect school

meal participation. Examples include valuing of family mealtime, as well as concerns over school meal quality and food choice (56,62,63).

2.3. Materials and Methods

2.3.1. Data Collection

This study uses survey data collected by the National Food Access and COVID Research Team (NFACT), a multistate collaborative effort (64). Survey questions examine various aspects of Vermonters' experiences with food access and food security and related worries during the pandemic, in addition to a broad set of demographic characteristics (64). Multiple iterations of the survey, beginning in March 2020, have been administered, both within the state of Vermont and nationally, with modifications occurring at each stage. This study incorporates data collected online between July 29, 2020 and September 17, 2020 from a sample of Vermont residents recruited by the survey research firm Qualtrics. Qualtrics engages online research panels of respondents, typically recruited from a pool of candidates who have previously agreed to future contact, based on a predetermined set of demographic characteristics. Our sample of 600 Vermonters (age 18 and older) reflects the state's population profile with respect to race, ethnicity and income (64).

2.3.2. Relevant Variables

Independent variables for this study included select demographic characteristics and binary variables reflecting participation in three federal nutrition assistance programs: SNAP, WIC and school meals. Of note, we classify recipients of the special

Pandemic Electronic Benefits Transfer (P-EBT) program, offered to families of children who would have received free or reduced school meals prior to shutdowns, as school meal participants. To compensate for relatively small sizes within each category, most demographic variables (e.g., gender, race) are condensed or analyzed as binary (Table 1). Due to concerns over data sensitivity, we do not collect information on immigration status.

Table 1. Complete list of variables, questions and scales used in analysis.

Variable	Survey Question	Scale
<i>Demographic Variables</i>		
Age Group		1= 18-34 years, 2 = 35-54 years, 3 = 55 year+
Female	Which of the following best describes your gender identity?	1= Female, 0 = Not Female*
Income	Which of the following best describes your household income range in 2019 before taxes?	1 = Less than \$10,000, 2 = \$10,000 to \$24,999, 3 = \$25,000 to \$49,999, 4 = \$50,000 to \$74,999, 5 = \$75,000 to \$99,999, 6 = \$100,000 or more*
Children	Are there children in your household?	0 = No children in HH 1 = Yes, children in HH
Household Size		0= 1-2 members; 1= 3 or more members
BIPOC		1 = BIPOC, 0 = Not BIPOC*
Education	What is the highest level of formal education that you have completed?	1 = High School or less 2 = Some college or Associate degree 3 = Bachelors or Advanced degree*
Job Disruptions	Have you or anyone in your household experienced a loss of income or job since the COVID-19 outbreak (March 11 th , 2020)?	1 = Yes, 0 = No*
Rural/Urban Residence	Zip codes that intersect with a Census Urbanized Area or Urban Cluster (RUCA 2.0)	1 = Urban, 2 = Large Rural, 3 = Small Rural, 4 = Isolated
Low-income	Income less than 200% of the federal poverty level based on household size.	1 = Low-income, 0 = Not low-income
<i>Diet, Food Security and Stress Variables</i>		
Fruit Consumption	Determined based on responses to reported fruit intake as compared to USDA recommendation for	1 = Met Recommendation, 0 = Did Not Meet Recommendation

Vegetable Consumption	fruit intake (2 or more cups daily to meet recommendation) Determined based on responses to reported vegetable intake as compared to USDA recommendation for vegetable intake (2.5 or more cups daily to meet recommendation)	1 = Met Recommendation, 0 = Did Not Meet Recommendation
Food Security	Determined based on the responses to the US Household Food Security Survey Module Six-Item Short Form.	1 = Food Insecure, 0 = Food Secure
Perceived Stress Scale	Perceived Stress Scale Score calculated based on responses to: In the last month, how often have you felt that you were unable to control the important things in your life? In the last month, how often have you felt confident about your ability to handle your personal problems? In the last month, how often have you felt that things were going your way? In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	0-16 (higher scores reflect higher stress)

Federal Nutrition Assistance Program Participation Variables

SNAP Participation	Has your household used SNAP benefits since the start of the outbreak?	1 = Yes, 0 = No
WIC Participation	Has your household used WIC benefits since the start of the outbreak?	1 = Yes, 0 = No
School Meals Participation	Has your household used a school meal program since the start of the outbreak?	1 = Yes, 0 = No

Program Experience Variables

SNAP Questions	SNAP benefits are enough to meet our household's needs Overall, SNAP benefits are easy to use to buy food for our household We cannot use SNAP benefits to pay for groceries ordered online We are not able to use our full months' worth of SNAP benefits	1 = Strongly disagree, 2 = Disagree, 3 = Neither agree nor disagree, 4 = Agree, 5 = Strongly agree 1 = Strongly agree, 2 = Agree, 3 = Neither agree nor disagree, 4 = Disagree, 5 = Strongly disagree
Additional SNAP Comments		Open-ended

WIC Questions	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	1 = Strongly disagree, 2 = Disagree, 3 = Neither agree nor disagree, 4 = Agree, 5 = Strongly agree
Additional WIC Comments		Open-ended
School Meals Questions	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 re-heat 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	1 = Strongly disagree, 2 = Disagree, 3 = Neither agree nor disagree, 4 = Agree, 5 = Strongly agree, 99 = I don't know
Additional School Meals Comments		Open-ended
Questions for All Program Participants	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	1 = Strongly disagree, 2 = Disagree, 3 = Neither agree nor disagree, 4 = Agree, 5 = Strongly agree, 99 = I don't know

Note. For these variables, the start of the outbreak is defined as March 11, 2020.

* Original categories were condensed

Variables were also created to reflect participation in multiple or any federal nutrition assistance program. As one aim of this study was to distinguish between low-

income and other program participants, we created a variable to reflect participants that fell above or below 200% of the federal poverty level (FPL) based on household size. To do so, first, average household income was calculated based on reported categories. To calculate, we averaged each income category (i.e., if the respondent reported a household income between \$10,000 and \$14,999, this was averaged to \$12499.50). These averages were compared to 200% of the FPL based on reported household size (65). If a respondent's average household income fell below the 200% threshold, they were classified as low income.

We also evaluate four dependent variables based on self-reported data: food security, fruit intake, vegetable intake, and perceived stress. Food security status is evaluated using the validated USDA 6-item short-form food security module, modified to reflect experiences since the start of the pandemic (March 2020) (66). Following established scoring procedures, respondents who answer 2 or more out of the 6 survey questions positively are classified as food insecure (66).

Survey respondents reported perceived fruit and vegetable intake based on binned categories (none, 1/2 cup or less, 1-2 cups... 4 or more cups). For analyses, these are condensed to reflect whether perceived intake did or did not meet USDA guidelines for fruit and vegetable intake (67). Given that established thresholds for fruit (2 cups) and vegetable (2.5 cups) intake do not neatly correspond with survey categories, any respondents reporting fruit intake of 1-2 cups or more and vegetable intake of 2-3 cups or more of vegetables are classified as meeting intake recommendations. Accordingly, our

recategorization may slightly overestimate the proportion of respondents who meet fruit and vegetable intake recommendations.

Stress is measured using the validated 4-item perceived stress scale (68), which poses a series of scenarios to which respondents indicate that they occur never (0) to very often (4). The scale is corrected for all questions so that higher scores reflect higher stress, which requires reverse scoring on two of the four questions. Results are then summed for an overall perceived stress score of 0-16.

Finally, respondents who participated in federal nutrition assistance programs were asked to respond on a 5-point Likert scale (strongly disagree to strongly agree) to several statements regarding their experiences with the programs. Participants were given the option to make further optional comments on their experiences.

2.3.3. Data Analysis

We use descriptive statistics to assess individual demographic characteristics of federal nutrition assistance program participants and their experiences with these programs during the early months of the COVID-19 pandemic, and bivariate tests (chi-2 or t-tests, based on data type) to assess demographic differences between low-income program participants and nonparticipants with an alpha level of .05 indicating significant differences. Where sample size allows, statistical tests are conducted on SNAP and WIC participants separately. We also summarize open-ended comments provided by nutrition assistance program participants about the programs. Notably, open-ended responses were optional, and many respondents elected not to provide substantive comments, such that broad trends are difficult to identify, particularly among the small WIC subsample. Given

the small sample of qualitative data, comments were divided by relevant program and coded into three broad themes using NVIVO version 20 (69): program challenges, program benefits, or both.

In order to estimate the effects of federal nutrition assistance program participation on food security, fruit and vegetable intake, and perceived stress, we use chi-square tests, t-tests, and nearest neighbors matching techniques. Nearest neighbors matching is useful to approximate causal treatment effects where only observational data is available (70). In simple terms, matching techniques attempt to compensate for selection bias by selecting those untreated individuals who are most similar to a sample of treated individuals based on a set of predefined relevant characteristics. In the context of this study, federal nutrition assistance program participation serves as the treatment. However, given the significant variation in programming between school meal programs, SNAP and WIC, we run matching analyses on participants of any nutrition assistance program and with school meal participants broken out into their own treatment group to compare results. Additionally, school meal eligibility during this time was universal rather than income-based, further distinguishing the program from SNAP and WIC. SNAP and WIC participants are analyzed together as a single treatment group due to the small sample size of WIC participants. All analyses are stratified by income (low/high) to assess the differential impacts of nutrition assistance program participation on these groups. In each of these analyses, we match program participants to nonparticipants based on a set of six demographic covariates that are likely to be associated with program participation or relevant outcomes: age (under 35), children in household, negative job

change, education (at least a bachelor’s degree), household size (4 or more individuals), and rurality.

Nearest neighbors matching techniques are based on a measure of distance, called a caliper, that evaluates the relative similarity of demographic covariates between individuals. Matches are selected based on the shortest “distance” that can be found, but to ensure quality matches we set a maximum caliper for each analysis at the smallest caliper (shortest distance) that allowed at least 2 matches to be found. Calipers vary slightly between analyses, but all were set at a maximum of between .15 and .25, with higher calipers employed for analyses in which matches were more difficult to find. Using these matches, we report average treatment effect on the treated, which assesses the difference between expected outcomes (food security, fruit intake, vegetable intake, and perceived stress) with and without treatment (nutrition assistance programs) for those who participate in treatment (70).

2.4. Results

2.4.1. Descriptive Statistics

2.4.1.1. Sample Demographics

Table 2 depicts demographic characteristics by group. About one in three respondents (n=202) were classified as low-income. Of the full sample (N=600), 44.2% were over 55 years, but only 28.2% fell into this category when restricted to low-income respondents, with the largest proportion of this group aged 18-34 (40.6%). Most respondents were female in both the full sample (67.3%) and the low-income group

(76.2%). Average household size was 2.61 people (std. dev = 1.569) for the full sample and 2.93 people (std. dev = 2.034) for low-income participants, with 29.7% and 41.1% reporting children in the household, respectively. Of total respondents, 8.2% identified as BIPOC and/or Hispanic ethnicity as compared to 9.9% within the low-income category. Within the full sample, 47.7% of respondents had at least a college degree, whereas only 21.3% of low-income fell into this category. Forty five percent of total respondents and 52.5% of low-income respondents lived in households that experienced a negative job change during the first 4-5 months of the pandemic, including job loss, furlough or reduction in hours. Only 35.3% of total respondents and 28.7% of low-income respondents lived in an urban setting.

Table 2. Demographic characteristics of full sample, low-income respondents and federal nutrition assistance program participants.

Demographic Characteristic		Full Sample (N=600)	All Low Income (n=202)	Low-income nonparticipants (n=86)	School Meals (n=68)	Any Program (n=164)	SNAP and WIC Only (n=124)
Age Group (%)	18-34 years	26.2 (157)	40.6 (82)	50.0 (43)	44.1 (30)	34.8 (57)	33.1 (41)
	35-54 years	29.7 (178)	31.2 (63)	20.9 (18)	50.0 (34)	41.5 (68)	38.7 (48)
	55 years+	44.2 (265)	28.2 (57)	29.1 (25)	5.9 (4)	23.8 (39)	28.2 (35)
Gender ID	Female	67.3 (404)	76.2 (154)	83.7 (72)	70.6 (48)	69.5 (114)	68.5 (85)
	Not Female	32.7 (196)	23.8 (48)	16.3 (14)	29.4 (20)	30.5 (50)	31.5 (39)
Income	Less than \$10,000	6.2 (37)	17.8 (36)	16.3 (14)	8.8 (6)	13.4 (22)	16.1 (20)
	\$10,000 to \$24,999	14.0 (84)	40.1 (81)	33.7 (29)	17.6 (12)	32.3 (53)	38.7 (48)
	\$25,000 to \$49,999	23.8 (143)	39.1 (79)	46.5 (40)	26.5 (18)	26.8 (44)	27.4 (34)
	\$50,000 to \$74,999	17.3 (104)	2.5 (5)	2.3 (2)	16.2 (11)	11.0 (18)	8.9 (11)
	\$75,000 to \$99,999	14.5 (87)	.5 (1)	1.2 (1)	22.1 (15)	10.4 (17)	4.8 (6)
	\$100,000 or more	24.2 (145)	0 (0)	0.0 (0)	8.8 (6)	6.1 (10)	4.0 (5)
Children	No children in HH	70.0 (415)	58.9 (119)	68.6 (59)	11.8 (8)	42.9 (70)	52.0 (64)
	Children in HH	30.0 (178)	41.1 (83)	31.4 (27)	88.2 (60)	57.1 (93)	48.0 (59)
Household Size	1-2 members	60.2 (357)	46.5 (94)	44.2 (38)	14.7 (10)	41.1 (67)	49.6 (61)
	3 or more members	39.8 (236)	53.5 (108)	55.8 (48)	85.3 (58)	58.9 (96)	50.4 (62)
BIPOC	BIPOC	8.2 (49)	9.9 (20)	11.6 (10)	8.8 (6)	10.4 (17)	12.1 (15)
	Not BIPOC	91.8 (551)	90.1 (182)	88.4 (76)	91.2 (62)	89.6 (147)	87.9 (109)

Education	High School or less	19.0 (114)	33.7 (68)	32.6 (28)	29.4 (20)	31.1 (51)	34.7 (43)
	Some college/Associate	33.3 (200)	45.0 (91)	34.9 (30)	39.7 (27)	47.0 (77)	46.8 (58)
	College degree or more	47.7 (286)	21.3 (43)	32.6 (28)	30.9 (21)	22.0 (36)	18.5 (23)
Job	Any job change	46.2 (270)	54.4 (106)	56.1 (46)	57.4 (39)	54.0 (87)	52.1 (63)
Disruptions	No job change	53.8 (314)	45.6 (89)	43.9 (36)	42.6 (29)	46.0 (74)	47.9 (58)
Rural/Urban	Urban	35.4 (212)	28.9 (58)	23.5 (20)	27.9 (19)	32.9 (54)	34.7 (43)
Residence	Rural	64.6 (387)	71.1 (143)	76.5 (65)	72.1 (49)	67.1 (110)	65.3 (81)
Low-income	Low-income	33.7 (202)	--	--	50.0 (34)	70.1 (115)	80.6 (100)
	Not low-income	66.3 (398)	--	--	50.0 (34)	29.9 (49)	19.4 (24)

Note. Sample size is adjusted for several variables based on missing data. Within the full sample, n=593 for children in household and household size; n=594 for job disruptions; n=599 for rural/urban residence. Within the low-income non-participants, n=85 for rural/urban residence.

2.4.1.2. Federal Nutrition Assistance Program Participation

Of all respondents, 27.3% (n=164) reported that their household used at least one federal nutrition assistance program and 5.67% (n=34) reported that their household used two or more programs. Divided by program, 68 respondents participated in a school meal program, 114 participated in SNAP and 25 participated in WIC.

Over half (57.4%, n=116) of low-income respondents participated in at least one federal nutrition assistance program. Among these respondents, there is a significant association between age and program participation, with 47.6% of 18–34-year-olds participating, compared to 71% of 35–54-year-olds and 56.1% of those 55 and over (Table 3). We also find significant associations between program participation and gender ($\chi^2(1) = 4.778, p=.029$), and presence of children in the household ($\chi^2(1) = 6.075, p=.014$) with higher participation among those who do not identify as female and those living in a household with children. Finally, we find a significant association between program participation and education, with the highest rates of participation among those who have some college or an associate degree (compared to those with more or less

education), and the lowest rates of participation among those with a college or advanced degree.

We also find significant associations between program participation and gender ($\chi^2(1) = 4.778, p=.029$), presence of children in the household ($\chi^2(1) = 6.075, p=.014$) and education, with higher participation among those who do not identify as female, have some college or an associate's degree (compared to those with more or less education), and those living in a household with children.

Table 3. Crosstab of federal nutrition assistance program participation by select demographic characteristics among low-income respondents (n=202).

Variable		Participating in any program (n=115), n (%)	Not participating in any program (n=86), n (%)	P Value
Age	18-34 years*	39 (47.6)	43 (52.4)	.019
	35-54 years*	44 (71.0)	18 (29.0)	
	55 years+	32 (56.1)	25 (43.9)	
Gender Identity	Female	81 (52.9)	72 (47.1)	.029
	Not Female	34 (70.8)	14 (29.2)	
Children	No children in HH	59 (50.0)	59 (50.0)	.014
	Children in HH	56 (67.5)	27 (32.5)	
Household Size	1-2 members	55 (59.1)	38 (40.9)	.609
	3 or more members	60 (55.6)	48 (44.4)	
BIPOC	BIPOC	10 (50.0)	10 (50.0)	.492
	Not BIPOC	105 (58.0)	76 (42.0)	
Education	High School or less	40 (58.8)	28 (41.2)	.002
	Some College/Associate*	60 (66.7)	30 (33.3)	
	College or advanced degree*	15 (34.9)	28 (65.1)	
Job Disruptions	Any job change	60 (56.6)	46 (43.4)	.727
	No job change	52 (59.1)	36 (40.9)	
Rural/Urban Residence	Urban	37 (64.9)	20 (35.1)	.181
	Rural	78 (54.5)	65 (45.5)	

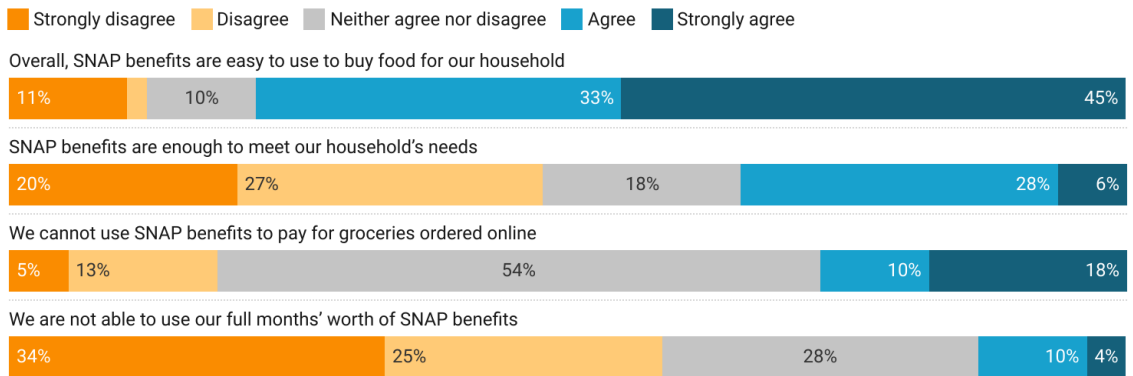
Note. Sample size is adjusted for several variables based on missing data. For non-program participants, n=83 for job disruptions; n=85 for rural/urban residence. For program participants, n=112 for job disruptions.

* Categories significantly different.

2.4.2. Program Experiences

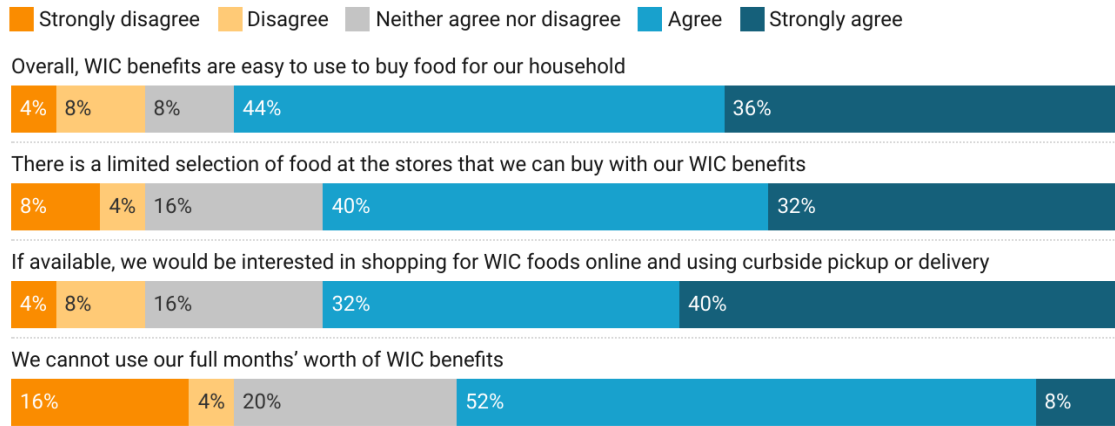
When asked to express their level of agreement with a series of position statements, most of both SNAP and WIC participants, 78% and 80% respectively, agreed or strongly agreed that the benefits are easy to use (Figure 1). Only 14% of SNAP participants agreed with the statement “we are not able to use our full months’ worth of SNAP benefits,” while, 60% of WIC participants agreed or strongly agreed that they could not use a full month’s worth of WIC benefits. However, nearly half (47%) of participants disagreed with the statement “SNAP benefits are enough to meet our household’s needs,” suggesting that benefits alone did not fully compensate for household food security needs. Just over half (54%) of SNAP participants neither agreed nor disagreed that they were unable to use their benefits to order groceries online, suggesting that these respondents may not have attempted to do so. However, of WIC participants, 72% agreed or strongly agreed that they would be interested in online shopping for WIC foods with delivery or curbside pickup options. Seventy-two percent also agreed with the observation that there is a limited selection of foods that can be purchased with WIC benefits (Figure 2).

Figure 1: Experiences of SNAP participants during the early months of the COVID-19 pandemic in Vermont.



Source: Infratest dimap • Created with Datawrapper

Figure 2: Experiences of WIC participants during the early months of the COVID-19 pandemic in Vermont.



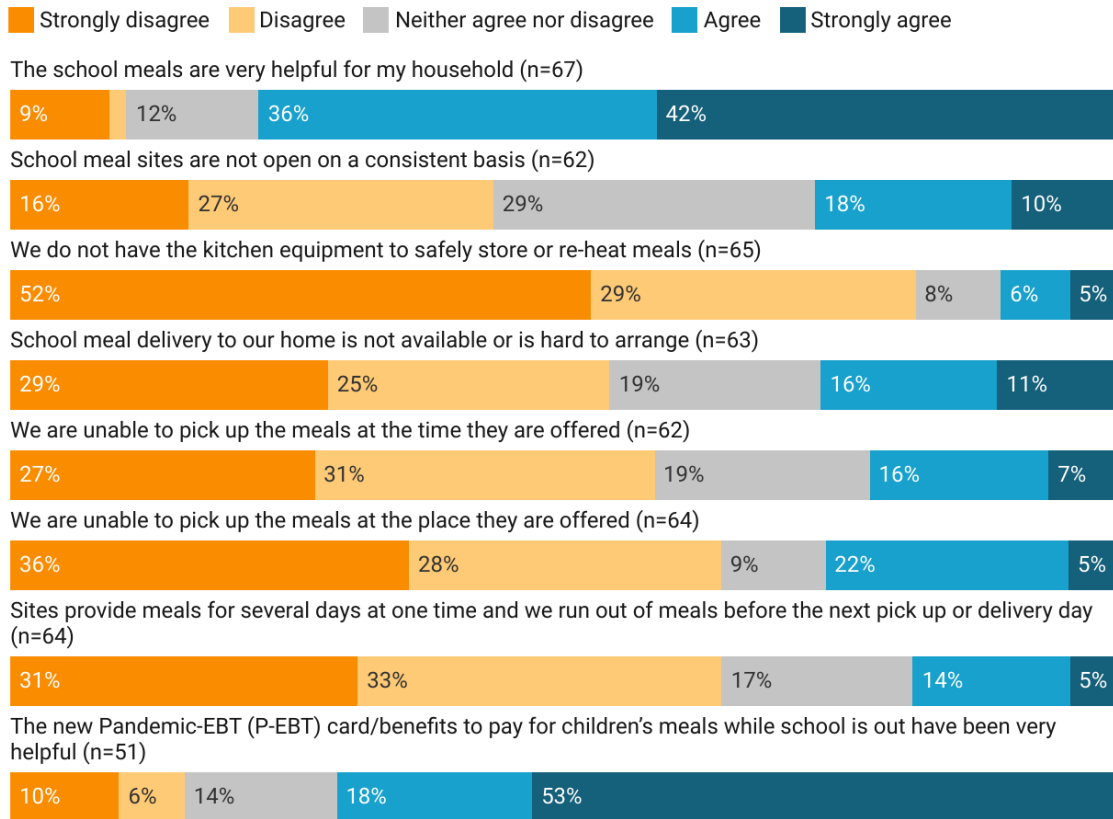
Source: Infratest dimap • Created with Datawrapper

Most school meal participants (78%) and P-EBT recipients (71%) agreed that these programs had been helpful to their families. When asked to report their level of agreement with specific challenges related to school meals during the pandemic, the most common complaints were that school meal sites were not consistently open (28%), home delivery was not available or was difficult (27%), and that participants were unable to pick up at the sites (27%) and times (23%) offered. Fewer than 20% of participants reported running out of meal provisions before the next delivery dates (19%) or limitations related to inadequate kitchen equipment needed to store and reheat meals (11%).

Among all program participants, 35% agreed that they did not want to rely on nutrition assistance programs because they valued personal independence and 22% expressed worry that others would find out they used programs. Others expressed pragmatic concerns with qualifying and recertifying for programs, including possessing

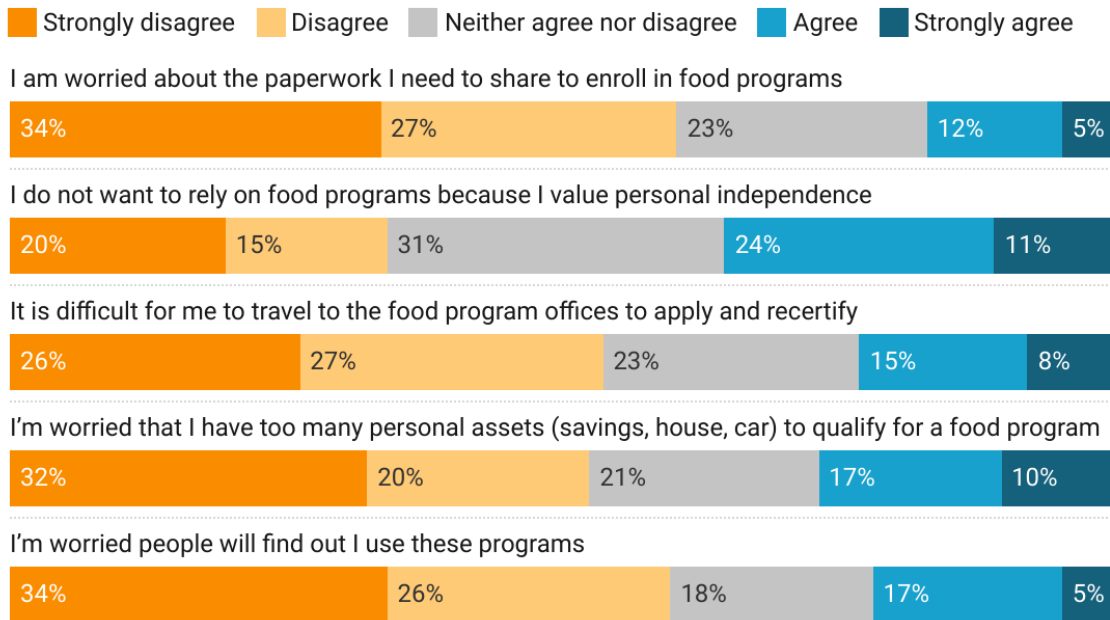
too many personal assets to be eligible (27%), difficulties travelling to program sites for appointments (23%), and worries over the paperwork needed to enroll (17%).

Figure 3: Experiences of School Meals recipients during the early months of the COVID-19 pandemic in Vermont.



Created with Datawrapper

Figure 4: Experiences of federal nutrition assistance program participants during the COVID-19 pandemic in Vermont.



Source: Infratest dimap • Created with Datawrapper

In open-ended comments, participants responded with a mix of gratitude for the programs along with discussion of challenges and limitations. About a quarter of WIC participants provided further comments on their experiences, of which a couple commented that the selection of foods offered was limited, and not always available during the pandemic, e.g., “it’s been harder to get certain WIC items since COVID”. Over a dozen SNAP participants, or roughly a third of those who provided qualitative data, commented on the helpfulness of the program during the pandemic, with particular emphasis on the necessity of the temporary increase in benefits provided: “the increase was very much appreciated and needed”; “the extra money is necessary for both before and after the pandemic”.

However, echoing responses to closed-ended questions, numerous SNAP participants elaborated on challenges they faced with their benefits. Some argued that, even with temporary increases, benefits were inadequate to meet their needs, whether due to rising costs or supply shortages: “It’s not enough given the rising costs of everything,” said one participant, while another stated, “I feel like the benefits didn’t go as far because I had to buy name brand items due to [the] store brand [being] sold out”. Another respondent observed cyclical challenges associated with benefits noting that “everyone shops on the first of the month, if the store is out, some people go without. I get SNAP & SSI [social security insurance], and my money is all gone by the 10th of every month”. Other observed challenges included bureaucratic issues in qualifying, limited benefit eligibility due to age and seemingly arbitrary changes to benefits, as well as limited opportunities to shop online.

Participants were also given the opportunity to comment on the P-EBT and school meal programs, resulting in substantive comments from about 20 participants. Most responses suggested that the programs had been helpful: “I don’t know what we would have done with[out] the school meals. We appreciate them more than many people can imagine.” However, a small subset reiterated that the programs were still “Not enough to feed the kids,” or wished for their continuation, i.e., “P-EBT was a blessing and I wish we had more”. Although few specific challenges were discussed, one respondent did note that their family did not prefer the taste of school meals, and another that delivery options were important to the value of school meals during the COVID-19 pandemic: “When meals were being delivered by bus, they were very helpful. Grocery

stores didn't have items we needed in stock, and buying groceries was more expensive than school lunches had been. Getting food deliveries was very helpful to my family. When they stopped delivering, we were unable to pick up meals at the allotted time.”

2.4.3. Outcome Variables

2.4.3.1. Overview

Among all respondents, 71.0% were consistently food secure since the start of the COVID-19 pandemic. Most did not meet USDA recommendations for either fruit intake (58.5%) or vegetable intake (72.3%). The average perceived stress score (out of 16) was calculated to be 6.85 for the full sample. Low-income respondents were significantly less likely than higher income respondents to meet fruit and vegetable recommendations ($p<.001$) and were significantly more likely to have experienced food insecurity and higher perceived stress since the start of the COVID-19 pandemic ($p<.001$).

Table 4. Dependent variable frequencies for full sample, low-income respondents, and federal nutrition program participants.

Outcome Variables		Full Sample (N=600)	All Low-Income (n=202)	Low-Income No Programs (n=86)	School Meals (n=68)	Any Program (n=164)	SNAP and WIC (n=124)
Fruit Recommendation	Met	41.5 (249)	29.2 (59)	36.0 (31)	39.7 (27)	32.9 (54)	29.0 (36)
	Did not meet	58.5 (351)	70.8 (143)	64.0 (55)	60.3 (41)	67.1 (110)	71.0 (88)
Vegetable Recommendation	Met	27.7 (166)	15.3 (31)	26.7 (23)	17.6 (12)	14.6 (24)	12.1 (15)
	Did not meet	72.3 (434)	84.7 (171)	73.3 (63)	82.4 (56)	85.4 (140)	87.9 (109)
Food Security	Food Secure	71.0 (414)	39.9 (77)	50.6 (41)	53.8 (35)	42.5 (68)	36.1 (44)
	Food Insecure	29.0 (169)	60.1 (116)	49.4 (40)	46.2 (30)	57.5 (92)	63.9 (78)
Perceived Stress Score		6.85	8.37	8.49	7.35	7.98	8.17

Note. Sample size is adjusted for several variables based on missing data. For the food security variable, n=583 for the full sample; n=193 for the low-income sub-sample; n=81 for program non-participants; n=65 for school meal participants; n=160 for all program participants; n=122 for SNAP/WIC participants. For the perceived stress variable, n=597 for the full sample; n=201 for the low-income subsample; n=163 for all program participants; n=123 for SNAP/WIC participants.

2.4.3.2. Federal Nutrition Assistance Program Participation and Food Security

We find a significant association between federal nutrition assistance program participation and food insecurity through chi-square tests, with 18.1% of nonparticipants classified as food insecure, compared to 57.5% of participants ($\chi^2(1) = 87.436$, $p < .001$) within the full sample. This association held for SNAP, WIC and school meal participation ($p = .001$) for the full sample of respondents, but when low-income respondents were examined alone, there was no significant relationship between school meal participation and food insecurity, and the association was weaker but still significant for SNAP/WIC participants ($p = .031$). However, when low-income SNAP and WIC respondents were examined separately, the significance held for SNAP but not WIC respondents.

Using matching techniques to approximate the effects of federal nutrition assistance program participation on food security, we find a significant association between participation in any program and increased food insecurity since the start of the COVID-19 pandemic, both for the higher income ($p = .001$) and the low-income group ($p < .001$). In other words, among similar higher-income households, those using any federal nutrition assistance program are more likely to be food insecure compared to those who are not using any program. The same is found when comparing among otherwise similar low-income households. When school meal participation and SNAP/WIC participation are evaluated as separate treatments, we find that this association holds true for SNAP/WIC participation among respondents that are not low-income ($p < .001$) (Table 5).

Table 5. Food insecurity of federal nutrition assistance program participants as compared to nonparticipants using matching analysis.

		Coefficient	Robust Std. Error	p=	95% CI		Total n matched
Higher Income Respondents	SNAP/WIC	0.313	0.030	<0.001*	0.254	0.373	234
	School Meals	0.086	0.098	0.383	-0.107	0.279	134
	Any Program	0.256	0.077	0.001*	0.105	0.407	362
Lower Income Respondents	SNAP/WIC	0.087	0.087	0.317	-0.083	0.256	234
	School Meals	-0.107	0.105	0.305	-0.313	0.097	134
	Any Program	0.323	0.089	<0.001*	0.149	0.498	362

Note. Each program participation variable was used as a “treatment” in a separate matching analysis while using six demographic controls (gender, children in household, education negative job change, household size, rural/urban) to conduct the matching. Negative coefficients reflect an association with increased food security.

2.4.3.3. Federal Nutrition Assistance Program Participation and Fruit and Vegetable

Intake

We use matching analysis and chi-square tests to evaluate associations between program participation and fruit and vegetable intake. Using chi-square tests we find a significant association between SNAP/WIC program participation and reduced probability of meeting fruit intake recommendations in both the full sample ($p=.001$) and low-income subgroup ($p=.049$), but not for school meals. This trend is also significant in the full sample when all programs are grouped ($p=.008$). When SNAP and WIC are examined separately, only SNAP participation within the full sample is significantly associated with reduced fruit intake ($p=.001$). When matching analysis is used to account for select demographic controls, we find no significant associations for individual programs, but we do see a significant association between participation in any program and reduced probability of meeting fruit intake recommendations within the low-income group (Table 6; $p=.048$), meaning that for low-income households participating in a

program, compared to other low-income households not participating in a program, there is lower likelihood of meeting fruit intake recommendations.

Table 6. Fruit intake of federal nutrition assistance program participants as compared to nonparticipants using nearest neighbors matching analysis.

		Coefficient	Robust Std. Error	p=	95% CI		Total n matched
Higher Income Respondents	SNAP/WIC	0.006	0.009	0.483	-0.012	0.025	238
	School Meals	0.002	0.116	0.986	-0.225	0.229	134
	Any Program	0.048	0.088	0.590	-0.125	0.220	372
Lower Income Respondents	SNAP/WIC	-0.067	0.082	0.414	-0.227	0.094	238
	School Meals	-0.097	0.114	0.393	-0.320	0.126	134
	Any Program	-0.183	0.092	0.048*	-0.363	-0.002	372

Note. Each program participation variable was used as a “treatment” in a separate matching analysis while using six demographic controls (gender, children in household, education negative job change, household size, rural/urban) to conduct the matching. Negative coefficients reflect an association with a reduced probability of meeting recommended fruit intake levels.

Using chi-square tests we find a significantly reduced probability of meeting vegetable recommendations for both SNAP/WIC participants ($p < .001$) and all participants grouped ($p < .001$). Within the full sample, this trend holds for SNAP but not WIC when each is examined alone, but sample size precludes conducting this same analysis within the low-income subsample. We find a weaker association between SNAP/WIC participation and a reduced probability of meeting vegetable recommendations within the low-income group by matching analysis (Table 7; $p = .035$).

Table 7. Vegetable intake of federal nutrition assistance program participants as compared to nonparticipants using nearest neighbors matching analysis.

		Coefficient	Robust Std. Error	p=	95% CI		Total n matched
Higher Income Respondents	SNAP/WIC	0.050	0.117	0.669	-0.179	0.279	238
	School Meals	-0.106	0.108	0.328	-0.317	0.106	134
	Any Program	0.075	0.079	0.346	-0.081	0.230	372
Lower Income Respondents	SNAP/WIC	-0.122	0.580	0.035*	-0.235	-0.009	238
	School Meals	-0.111	0.075	0.141	-0.259	0.037	134
	Any Program	-0.101	0.069	0.141	-0.237	0.034	372

Note. Each program participation variable was used as a “treatment” in a separate matching analysis while using six demographic controls (gender, children in household, education negative job change, household

size, rural/urban) to conduct the matching. Negative coefficients reflect an association with a reduced probability of meeting recommended vegetable intake levels.

2.4.3.4. Federal Nutrition Assistance Program Participation and Perceived Stress

Within the full sample, we find significantly higher rates of perceived stress among all grouped program participants ($p < .001$), SNAP and WIC together ($p < .001$) and SNAP participants alone ($p < .001$) by t-tests, with an average score of 8.17 for SNAP participants as compared to 6.53 for nonparticipants. However, school meal and WIC participants analyzed alone do not exhibit significantly higher rates of perceived stress, and no significant associations hold for any program when the sample is restricted to only low-income respondents.

We also use matching techniques to examine the effects of program participation on perceived stress. The only model for which we find significant effects of program participation on stress scores is that for school meal participation among low-income respondents, wherein we find a significant negative association indicating reduced stress (Table 8).

Table 8. Perceived stress score of federal nutrition assistance program participants as compared to nonparticipants using nearest neighbors matching analysis.

		Coefficient	Robust Std. Error	p=	95% CI		Total n matched
Higher Income Respondents	SNAP/WIC	0.403	0.535	0.451	-0.645	1.451	236
	School Meals	-0.088	0.779	0.910	-1.615	1.438	134
	Any Program	0.853	0.610	0.162	-0.344	2.059	370
Lower Income Respondents	SNAP/WIC	0.269	0.525	0.608	-0.759	1.297	236
	School Meals	-1.492	0.721	0.039*	-2.906	-0.079	134
	Any Program	1.001	0.575	0.080	-0.121	2.135	370

Note. Each program participation variable was used as a “treatment” in a separate matching analysis while using six demographic controls (gender, children in household, education negative job change, household size, rural/urban) to conduct the matching. Negative coefficients reflect an association with a reduced perceived stress score.

2.5. Discussion

This study builds on prior literature examining food insecurity during the ongoing COVID-19 pandemic by exploring the role of federal nutrition assistance programs within the context of Vermont, a predominantly rural state characterized by a relatively robust policy and social response to the pandemic (71). Rural populations experience higher rates of food insecurity and are more likely participate in nutrition assistance programs as compared to their urban counterparts (4,72). Vermont readily accepted and implemented numerous federal waivers made available in association with the Families First Coronavirus Response Act to increase the flexibility of programs in response to COVID-19, from provision of P-EBT to suspension of certain face-to-face interview requirements to the temporary restructuring of school meal delivery (73). The state also boasted among the lowest COVID-19 caseloads at the time of survey administration (71). We found that, despite shortcomings, participants generally perceived federal nutrition assistance programs as helpful or easy to use. We documented notable levels of food insecurity, suboptimal fruit and vegetable intake, and perceived stress among participants and non-participants alike. Understanding food and nutrition security and perceived stress outcomes under these conditions can provide insights regarding how nutrition assistance programs can provide for the most vulnerable even in such challenging times.

Our findings regarding nutrition assistance program perception correspond closely to prior studies on several counts. In line with calls for increased total SNAP benefit allotment in other studies (44,74), we find that 47% of participants felt that benefits were not adequate to meet their household's needs. Likewise, restricted product

options available through WIC are a continuing topic of debate (51), which is reflected in our results, although our respondents were not prompted make a value judgment on these limitations. Our results also suggest that online utilization options for SNAP and WIC participants could improve accessibility and efficacy of these programs, which echoes perceptions of convenience and time savings associated with online options in earlier studies (48,53,75,76). However, in considering expanding online options for these programs, it is important to revisit reported concerns, including associated transaction costs and limited control over selection and quality (75,77,78). Logistical challenges associated with school meal delivery in other studies, such as scheduling conflicts with school breakfasts (56,63), are more difficult to evaluate against our results, given the altered format of meal delivery during the pandemic. However, new and additional logistical challenges, including accessibility of school meals related to site location, timing, and lack of delivery options continue to pose challenges for a substantial number of participants. However, at-home options for school meals may overcome other perceived challenges, such as infringement on family mealtimes (63)

Despite a perception of utility among participants, we found that – aligning with prior literature (4,42) – federal nutrition assistance program participation was significantly associated with food insecurity for both low-income and higher income respondents, even when we explore this using matching techniques to compare similar households. We also found a reduced probability of meeting fruit intake recommendations for low-income program participants, and a reduced probability of meeting vegetable intake recommendations for low-income SNAP/WIC participants.

There is a substantial body of literature supporting the efficacy of federal nutrition assistance programs in alleviating food insecurity and, to some degree, improving diet quality (7,8,79). Our findings should be considered within the unique context of the time and place at which our data were collected, and of course, as subject to limitations in the analytical models employed. In the wake of unprecedented systemic disruptions, increases in food insecurity and perceived stress, alongside decreased fruit and vegetable intake, are to be expected. That these experiences are associated with federal nutrition assistance programs may in fact be indicative that these programs are effectively reaching those most in need of them. It has been documented that the pandemic exacerbated food insecurity (80) and changed eating patterns. While some studies have found evidence of increased fruit and vegetable intake during the pandemic (81), these impacts were not universal. In a survey of Michigan adults, Litton and Beavers (82) found that food insecure respondents not only consumed fewer fruits and vegetables than their food secure counterparts but were more likely to report decreasing fruit and vegetable consumption in the early months of the pandemic, for reasons including quality, availability, price, desire to reduce store trips, and fears of contamination. While fresh fruit and vegetable prices increased relatively little in comparison with meat, fish and dairy products during the early months of the pandemic (83), challenges in access related to fears of contamination and exposure and increased concerns over spoilage as a consequence of reduced grocery trips (82) should not be discounted. Limitations to online ordering options for SNAP and WIC participants are of particular relevance. While Vermont farmers markets were broadly able to remain open during much of the

pandemic, even brief closures posed substantial issues for farmers and patrons alike, and reduced vendor space and preordering requirements upon reopening may have impacted Vermonters who regularly relied on such avenues (84). Likewise, research suggests that baseline rates of perceived stress increased in response to the pandemic among populations including college students and frontline workers, among others (85–87).

Pandemic-specific challenges to food access may be particularly potent in a relatively rural context. Rural populations experience food insecurity at elevated rates, which may be exacerbated by structural barriers affecting access, such as large distances to supermarkets (88,89). It is possible that, under these conditions, online delivery or curbside pickup options were more challenging or prohibitively expensive for some rural residents. Additionally, social support systems and community networks may play a unique role in the mitigation of food insecurity in rural settings (90), and constraints associated with new social distancing regulation compliance may have impacted such avenues. Additionally, although roughly one-third of our sample is classified as rural using the Rural Urban Commuting Area 4 category (RUCA) designation, the population density is low across the state, with only approximately 45,000 people, or about 10% of the state's population residing in its largest city (91). In combination, exacerbated experiences of food and nutrition insecurity in concert with new structural barriers to nutrition assistance program utilization may have limited the capacity of programs to operate optimally or fully compensate for negative shifts in these outcomes for Vermont's rural population. These limitations leave room for new and expanded strategies to improve access to healthy foods among program participants.

Although few studies have focused specifically on perceived stress during the pandemic, food insecurity is positively associated with various indicators of poor mental health (31,32,92). Some research indicates that this relationship may be attenuated by participation in SNAP and WIC (35,36), but – in line with our findings – other studies have not identified a moderating effect (37). Interestingly, we do find that perceived stress was significantly lower among low-income respondents with a household member enrolled in a school food program. Few studies have explicitly evaluated the relationship between school meal participation and perceived stress of household members. Our results merit further investigation – Could school meal delivery or pickup have reduced the necessity of public ventures and associated risk of exposure for some families? Could school meal delivery and pick up options during the pandemic have influenced the frequency of family meals or reduced the burden of meal planning? While Nagata et al. (33) did not examine school meal participation during the pandemic, they do report a mediating effect of free groceries and meals on the association between food insecurity and poor mental health. Similarly, in a qualitative analysis, commercial family meal kit use has been associated with perceived benefits including reduced mental load for family meal providers (93). Additionally, evidence suggests that frequent family meals may be associated with lower rates of depressive symptoms and stress among parents (94). While these results cannot be directly applied to the role of school meals during the pandemic, further research could illuminate the pathways through which pandemic school meal formats might have impacted perceived stress in the household. It is also relevant to

consider that the reduced burden of applying for school meal programs was removed due to the universal delivery approach taken during the time period under study.

As with any study, our survey and methods are subject to reasonable limitations. Although our sample size is relatively modest, it has a margin of error of 4% and was intentionally designed to reflect Vermont's population on key demographic factors including income, race and ethnicity. Due to the limited sample of WIC participants, this population is only analyzed in conjunction with SNAP or both SNAP and school food participants, limiting the capacity of this study to distinguish between the impacts of these distinct programs. By design, our survey captures a breadth of data related to food insecurity during the COVID-19 pandemic but covering a substantial range of material naturally limits the depth of data that can practically be captured in any one area. Additionally, given the evolving nature of the pandemic context, subjects of importance to individual experiences of food and nutrition security continue to shift and emerge over time. For example, the administration of school meal programs was evolving at the time of data collection, making it challenging to clearly assess which specific program components and iterations participants responded to. Additionally, the limited number of open-ended responses collected suggests that the full breadth of participant experiences may not have been captured, although the supplementary qualitative data nonetheless adds depth.

Nearest neighbors matching analysis seeks to address weaknesses associated with selection bias in non-experimental study designs, but in the absence of perfect knowledge, such tools cannot perform perfectly. Although our survey captured many

demographic variables known to be associated with food and nutrition security, perceived stress and federal nutrition assistance program participation, these are complex constructs influenced by a myriad of interrelated factors. It is likely that additional confounding variables exist that we were unable to fully evaluate. For example, our matching analysis was not able to account for differences in social support, which has been shown to influence food insecurity and perceived stress. Additionally, we were unable to control for the role that disability, physical health and comprehensive mental or emotional health may have on these outcomes, although such factors are known to interact with the experience of food insecurity (92,95). Furthermore, our survey design could not meaningfully capture the specific food environments of participants, which can significantly impact food and nutrition security (88). Integrating these variables into future analyses might better isolate the impacts of federal nutrition assistance programs on food and nutrition security and perceived stress.

Of note, our matching analyses used binary outcomes to maximize power, except for perceived stress. However, by examining outcomes as binary, our models do not account for changes in the intensity of an outcome. While federal nutrition assistance program participation did not reduce food insecurity in our analysis, it is possible that participants may have experienced a reduction in the degree of food insecurity experienced, which would not be reflected in our models.

2.6. Conclusions

Within the context of a pandemic in the state of Vermont, federal nutrition assistance programs alone were broadly not adequate to alleviate the experience of food insecurity

and stress or increase fruit and vegetable intake. However, the documented increase in food insecurity throughout this time suggests that program participants may have faced unprecedented struggles in acquiring adequate food and that program efficacy should, in part, be evaluated according to the ability to reach and support vulnerable candidates. Additionally, participants perceived these programs as helpful and may have experienced other benefits, including reduced stress among low-income school meal program participants. Continuing research on the delivery and impacts of nutrition assistance programs, particularly in other rural contexts, is needed to inform their implementation. If federal nutrition assistance programs are to function effectively as vital safety nets, they must continue to evolve as new challenges to food and nutrition security emerge.

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