Journal of Applied Research on Children: Informing Policy for Children at Risk

Volume 6
Issue 2 *Nutrition and Food Insecurity*

Article 2

2015

Community Food Security Strategies: An Exploratory Study of Their Potential for Food Insecure Households with Children

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Acknowledgements
We are grateful to the Ohio State University Food Innovation Center for funding through their Innovation Initiative program (2013-2015). We appreciate our community-university team comprised of 14 faculty and 5 community partners. We are thankful for the students who collected data and the participants who gave voice to this research.

Introduction

In 2015, the United States Department of Agriculture (USDA) released its most recent report on food insecurity, documenting that nearly 49 million people (1 in 6) in the US are living in food-insecure households. Food-insecure households report reduced diet quality, variety, intake, or desirability.[1] Fifteen million (1 in 5) of these are households with children under age 18. Half of food-insecure households with children report food insecurity among children as opposed to adults in the household, with 1.1% reporting very low food insecurity. This means that children in those households skipped meals and experienced hunger.[1] In Franklin County, Ohio, child food insecurity rates exceed 24%.[2]

Health consequences of food insecurity include reduced consumption of fresh produce and higher rates of health conditions, often leading to limited mobility, work impairment, depression, anxiety, and social isolation.[3-8] Food insecurity also puts children at risk of developmental delays that may impact concentration, academic success, and positive social relationships.[7-9] Even after controlling for factors related to poverty, food-insecure children are more likely to suffer from malnutrition, cognitive issues, aggression, anxiety, increased hospitalizations, asthma, birth defects, and behavioral problems.[8-17]

Interventions to address food insecurity, unhealthy behaviors, and subsequent health concerns are often related to financial limitations in households.[18,19] In addition to financial constraints, it is important to consider the food environment. This includes: 1) affordability or the price variations among food sources and between processed food and fresh produce;[20-23] 2) accessibility in terms of transportation and distance to stores;[24,25] and 3) availability of food sources and varieties.[26,27]

In this study, a broader definition of community food security (CFS) is used to describe self-sufficient communities building upon community assets and emphasizing access to affordable nutrient-dense food.[28-31] The anti-hunger movement of the late 1970s and 1980s generally addressed hunger by providing emergency food assistance or federal food vouchers.[32] In the late 1990s and early 2000s, a shift toward community development models that emphasized both economic development and community revitalization occurred; developing urban agriculture and localizing food systems were seen as ways to address public health, cultural preferences, economic disparities, and environmental concerns.[33] The Community Food Security Coalition (CFSC) emerged in the mid-1990s with over 300 members and represented a diverse groups of scholars, practitioners, and activists united to address community food security at local, state, and national policy levels.[34] While the CFSC

officially disbanded in 2012, their legacy continues to this day in many forms. This includes the commonly used Community Food Assessment (CFA) evaluation tool, endorsed by the USDA, to assist community members with identifying community assets and needs related to food security, food production, food resources, and food affordability.[27] The CFSC also lobbied Congress to financially support community food projects designed to increase self-reliance and engage multiple stakeholders in communities to address food security, nutrition, and food access. Most recently, the National Institute of Food and Agriculture (NIFA) announced over $8.6 million in grant money through the Agricultural Act of 2014 and the Food and Nutrition Act of 2008 for planning efforts and projects that included multiple food system approaches incorporating food production, nutrition education, and reduction of food access barriers.[35,36]

The CFS framework is representative of the multidisciplinary community-university team as was employed to conduct this research. This extension to the community allows for the consideration of multiple intervention levels to address the food environment in addition to behavioral initiatives, including: 1) investing in food production; 2) retaining localized food knowledge; 3) increasing capacity for food-related economic opportunities;[28] and 4) addressing nutritional quality.[37] This framework is often employed in public health initiatives to reduce obesity and food security, especially in low-income communities.[34,38,39]

This research sought to explore nutrition and health-related issues of households with children who were food secure and food insecure in a large metropolitan area. It is contextualized by describing myriad interventions in this community that are intended to address food insecurity by decreasing barriers to accessing affordable and healthy dietary patterns. Lastly, this research explored the question as to whether participants' self-described food barriers and needs align with these programs and their potential usefulness in this community.

Background: Intervention Strategies to Address Food Access, Affordability, and Nutrition

Dietary patterns rich in produce are widely recommended for their health-promoting properties. Plant-based dietary components (fruits, vegetables, whole grains) are rich in phytochemicals and bioactive components that function as antioxidants, anti-inflammatories, phytoestrogens, and other preventive mechanisms.[40] Produce also supplies rich sources of dietary fiber, which is linked to a reduced incidence of obesity and obesity-related diseases such as type 2 diabetes, cancer, and cardiovascular disease.[41]

Additionally, nutrient-rich dietary patterns are associated with reduced risks of stroke, Alzheimer disease, cataracts, and other functional declines associated with aging.[40] Public and private programs at the federal, state, and local levels have been developed to address healthy food access. Though we will not describe all of them, a table of programs has been included (Table 4).

Public initiatives to increase access to nutritionally dense foods and thereby improve health outcomes are usually a hybrid of two forms: 1) demand-side approaches (adding customers by making healthy food more affordable) and 2) supply-side approaches (adding healthy food where there was insufficient relative to demand).[42] Demand-side approaches usually take the form of the issuance of food vouchers such as the Supplemental Nutrition Program for Women, Infants, and Children (WIC) with modifications for healthy food.[43-45] The Supplemental Nutrition Assistance Program (SNAP) transfers cash benefits to qualified low-income residents with which they may purchase food.[46-48] Both of these programs have been found to be effective in increasing the affordability of healthy food to low-income families.[44,49] However, not all neighborhood stores are eligible to participate in WIC or SNAP due to the current policy that requires eligible stores to offer at least 3 varieties of each staple food group (breads and grains, dairy, fruits and vegetables, and meat, poultry, and fish).[44] As such, many neighborhood stores are ineligible, thus requiring families to travel to distant participatory supermarkets for healthy food.

Community-based food strategies emphasize consumer relationships with producers and programs that incentivize purchasing food from local producers while also helping low-income consumers maximize their purchasing power. For example, Michigan's Double Up Food Bucks started in 2009 and is available at over 150 sites. This program improves low-income access to affordable healthy food by doubling SNAP dollars from $20 to $40.[50] Such programs have been shown to increase produce consumption, strengthen local economies, and increase earnings for farmers. Similarly, seniors and WIC participants may participate in voucher programs that can be redeemed at certified produce markets or farmers' markets. These programs have also been shown to increase participants' consumption of produce, improve shopping behaviors, and increase revenue for farmers.[51-54] WIC, specifically, has shown improvements in the mother's health and weight status, reduced infant mortality, improved birth outcomes, and childhood school readiness.[55-58]

Public programs specifically addressing childhood nutrition (beyond WIC) include the School Breakfast Program (SBP), National School Lunch Program (NSLP), Fresh Fruit and Vegetable Program, and Child Nutrition USDA Food Program. The NSLP serves over 31 million children each day and also provides eligible low-income households with free or reduced-price lunches.[59] Similarly, the SBP provides participating schools with opportunities to serve free or reduced-price breakfast to students.[60] Research has shown that eating breakfast strengthens childhood nutrition and health and improves attendance, attentiveness, and cognitive abilities.[61]

Educational programs are another form of demand-side strategies.[62-64] These may include nutrition education and cooking classes where residents are taught the nutritional value of and how to cook safely with produce at home.[42] In tandem with supply-side strategies, educational programs can be helpful in improving food access and reducing poor health outcomes associated with malnutrition. However, the sentiment behind them has been criticized as paternalistic, suggesting that residents would buy more healthy food if they knew how to prepare it.[42, 65-67] Research has found that families were not only knowledgeable of and valued healthy foods but that they also often traveled to distant neighborhoods where healthy food was readily available.[42]

Policies aimed at increasing the supply of healthy food in neighborhoods are usually rooted in local economic development plans aimed at attracting area supermarkets, equipping local corner stores with produce, developing farmers' markets, and/or utilizing mobile fresh produce markets, among other strategies.[67-72] Supply-side approaches reorient the argument toward the environment within which families live, and they seek to change the food environment from obesogenic-promoting or -sustaining to health-promoting.[67,73] However, supply-side strategies are also fraught with issues. Attracting large grocery stores to low-income areas is challenging due to site requirements, lack of political will and stakeholder buy-in, perceptions of safety, misunderstanding of the retail market and incentives, and insufficient income base to support store profitability, among other barriers.[71, 74]

More recently, planners and scholars have turned their attention to neighborhood corner stores as crucial players in effecting changes in neighborhood food environments. Corner stores are uniquely positioned to improve the nutritional environment, self-efficacy, and behavior related to healthy food access at the point of purchase. Corner stores are one of the few types of businesses that have remained viable in challenged communities and, subsequently, have maintained high use frequency.[75]

The city of Columbus, Ohio, for example, responded to a 2012 report that indicated that approximately 18% of its residents were food insecure by establishing the Fresh Foods Here (FFH) healthy corner store initiative.[77] This model sought to increase the availability of healthy, affordable foods, encourage improved consumption patterns, and increase consumer knowledge of healthy diets by incentivizing local corner stores to increase their offering of affordable, healthy foods in low-access areas. Two years after its implementation, results show 116% increase in the quantity of healthy food (e.g., fruits and vegetables, whole grains, low-fat dairy, low-sodium snacks) ordered by the store owners and a 61% increase in the quantity of healthy food sold.[77]

Methods

Sample

Cross-sectional surveys were administered online and in person from January to April 2014 after being approved by the Institutional Review Board. Twenty-one survey sites were chosen based on their proximity to the survey study area, their potential for reaching a diverse representation of the study area population, and their potential to provide space for surveying. The subsample of households with children (N = 151) came from a sample of 718 individuals living in a defined study area in a large, neighborhood-centric midwestern city of over 800,000 that participated in a comprehensive food mapping study. The defined study area provided a diverse and representative sample at the household level in terms of sociodemographic characteristics and at the neighborhood/community level in terms of differences in economic investment by the city of Columbus, Ohio, Ohio State University, and development groups.

Survey Design

A 20-minute survey instrument, based upon validated instruments, was developed through a series of group processes. These engagement processes involved members of a community-university team with expertise in food security, public health, urban and regional planning, agriculture, public policy, food justice, agroecosytems, nutrition, and social work.

The food access module addressed where households completed most of their food shopping; those locations were further distinguished by categories (i.e., supermarket; specialty stores; and convenience, carryout, or corner stores). Food access also addressed types of transportation used, distance traveled to access food, and barriers preventing households from obtaining the food. Additional questions concerning food-

provisioning strategies were also asked (e.g., use of food pantry or personal/community garden).

The food patterns module focused on how households make decisions about the types of food they consume and what was most important to them when making food choices. Special emphasis was placed on the consumption of fruits and vegetables and any barriers to desired consumption of fruits and vegetables.

Questions related to the neighborhood environment were also included. This included perceptions about the ease with which households can find fruits and vegetables, food support service, and affordable food.

Health conditions related to diet were included to obtain descriptive information about the health of residents in the study area. This included asking whether participants had been to a health professional in the past year and whether the participant or members of the household had ever been told they had type 2 diabetes, prediabetes, high blood pressure, high cholesterol, cancer, and/or gout. Body Mass Index (BMI) was calculated based on self-reported height and weight.[78] BMI categories are defined as <25 = normal and ≥25-29.9 = overweight/obese.

The food security survey was based on the USDA's 6-item short form, a validated surrogate tool based on the 18-item Household Food Security Survey Module. The abbreviated version was selected since the longer module posed a length constraint and burden to respondents.[74] Households were categorized as food secure or food insecure based on participants' responses to the validated scale.[79]

Data Collection

Twenty-eight (28) students were trained to administer the survey. They were recruited through the research team's network of faculty, staff, and community partners. All completed the Collaborative Institutional Training Initiative (CITI) human subjects resource training and signed a Conflict of Interest form, allowing them to serve as key personnel. They attended a 2-hour training session. To avoid periodicity issues, interviewers varied their interview hours within the survey location hours and days. Incentives of light snacks and bottled water were offered. Survey participants could also enter a raffle for $25-$50 grocery gift cards and 2 digital tablets. A food resource guide was available to anyone interested.

Volunteers completed a tracking form to assist in calculating the response rate as well as identifying any patterns in those who opted not to participate. If patrons provided a reason for nonparticipation, it was logged on this tracking form. To minimize selection bias, surveyors made every attempt to follow the protocol to approach every third patron (e.g., every

third person who enters the location after the interviewer is ready; every third person waiting in line; every third person leaving the location).

Data Analyses

The online data set was coded and cleaned prior to being merged with the in-person data set. Data were cleaned, and raw data involving computations (i.e., food security and BMI) were collapsed into categorical data. Since food security was a primary focus, any participants who failed to answer the food security survey questions were removed from the data set. Since this research is exploratory and meant to provide baseline summaries of participant responses, initial descriptive analyses were conducted. Secondary chi-square analyses were conducted to determine whether there were significant differences for very low food-secure, low food-secure, and food-secure households with children. Chi-square analyses were used because the majority of the demographic data and food security status are categorical level variables. An Analysis of Variance (ANOVA) was run to examine whether there were significant differences in age among the food security categories and to examine the mean differences of fruit and vegetable consumption. This test was used since age and consumption are uncategorized and continuous variables.

Results

Demographic Data

Our initial sampling of adults yielded responses to 809 surveys (606 online and 203 in person). After data cleaning, 718 completed surveys were retained, representing approximately 1% of the study area. From this cohort, we extracted cases (N=151) where respondents indicated they lived in households with children for this study. A summary of their characteristics are presented in Table 1. We sampled adults between 18 and 64 years of age with the average age of participants being 39 years. Of households with children, 72% of the interviewees were women, and this majority was consistent across the 2 categories of food security. More than half (56%) of participants reported their race and ethnicity as non-Hispanic white, while 33% self-identified as black or African American. Approximately 11% stated their ethnicity as Hispanic or reported another race. More than three-quarters of respondents (78%) stated they were employed full time, and 20% reported that they received incomes through disability benefits, veterans benefits, or Social Security. More than 80% of households were comprised of more than one adult, suggesting there were many fewer single-parent households than households with at least two adults. The participants in this study were relatively well educated,

with approximately 45% earning a bachelor's or graduate degree. One quarter (25%) of participants had a high school diploma, its equivalent, or less. The distribution of household incomes was relatively even: 18% had incomes less than $10,000, 19.6% of households had incomes between $10,001, and $24,999, 22% of households had incomes between $25,000 and $49,999, and 39% of households had earnings of $50,000 or more.

Analyses showed that respondents' income level ($p<.001$), race ($p<.001$), full-time employment status ($p<.001$), level of educational attainment ($p<.001$), and age ($p<.05$) were significantly different when stratifying across food security status categories. A significantly higher number of participants with income from Temporary Assistance for Needy Families (TANF), child support, unemployment, or workers' compensation were food insecure ($p<.01$). A significantly higher number of African Americans were food insecure ($p<.01$). The percentage of full-time workers was significantly higher in food-secure households, compared to very low food-secure households ($p<.01$). Additionally, persons with a college or graduate degree were represented more frequently in food-secure households. Age varied among the groups with food-insecure households significantly younger ($M = 37.09$, $SD = 11.57$).

Table 1. Sample Participant Characteristics

		All Households with Children N = 151		Food-secure Households with Children N = 84		Food-insecure Households with Children N = 67	
		Yes	**%**	**Yes**	**%**	**Yes**	**%**
Gender	Female	109	72.2	60	71.4	49	76.0
	Male	42	27.8	24	28.6	18	24.0
Race & Ethnicity	White	85	56.3	60	74.1	25	32.0
	Black/African American***	50	33.1	17	21	33	48.0
	Other	17	11.3	6	7.1	11	16.4
Employment Status	PT Worker(s)	49	36.3	28	36.8	21	31.3
	FT Worker(s)**	114	77.6	74	89.2	40	59.7
Household Type	HH with 1 Adult	26	16.6	9	10.7	17	25.3
	HH with >1 Adult	125	82.8	75	89.3	50	74.6
Income Sources	Social Security or Retirement	14	9.9	7	8.8	7	10.5
	Disability, SSI, Veterans Benefits	28	19.7	14	17	14	20.9
	Temporary, Seasonal, Cash-Based	19	12.6	10	11.9	9	13.4

		All Households with Children N = 151		Food-secure Households with Children N = 84		Food-insecure Households with Children N = 67	
	Other (TANF, child support, unemployment, Workers' Compensation)**	27	17.9	10	11.9	17	25.3
Education* **	High school, GED, or less	38	25.2	10	11.9	28	41.8
	Some college, no degree	32	21.2	11	13.1	21	31.3
	Associate's (2-year) degree	13	8.6	7	8.3	6	9.0
	Bachelor's or graduate degree	68	45.0	56	66.7	12	17.9
HH Income Level* **	Less than $10,000	27	18.2	5	6.2	22	32.8
	$10,001-$24,999	29	19.6	6	7.4	23	34.3
	$25,000-$49,999	33	22.3	16	18.7	17	25.4
	$50,000 or more	59	39.1	54	64.3	5	7.5
Age*	Mean (SD)	39.19 (10.63)		40.86 (9.56)		37.09 (11.56)	
	Range	18-64		18-64		18-60	

*p<.05
**p<.01
***p<.001

Health Status

We were also interested in how key health indicators were affected by the participants' food security status (Table 2). In general, 84% reported that they had visited a health professional in the past 12 months, distributed as 91% of adults in food-secure households and 75% of adults in food-insecure households. Reports of type 2 diabetes and prediabetes in households were higher in food-insecure households. Reports of high blood pressure were higher in food-insecure households at 36%, compared to 26% in food-secure households. Interestingly, hypercholesterolemia was lower in food-insecure households at 22%, compared to 26% of food-secure households. Cancer occurrences in food-insecure households were higher at 13%, compared to 6% in food-secure households. BMI, specifically obesity, was found to be a significant predictor in food security status. Nearly 51% of food-insecure households were obese, compared to 32% of food-secure households.

Table 2. Self-reported Health Conditions

	All Households with Children N = 151		**Food-secure Households with Children N = 84**		**Food-insecure Households with Children N = 67**	
	Yes	**%**	**Yes**	**%**	**Yes**	**%**
Visited a health Professional in Past 12 Mos. (Individual)	126	84.0	76	90.5	50	74.6
Type 2 Diabetes & Prediabetes (Household)	38	25.2	19	22.6	19	28.4
High Blood Pressure (Household)	46	30.5	22	26.2	24	35.8
High Cholesterol (Household)	37	24.7	22	26.2	15	22.4
Cancer (Household)	14	9.3	5	6.0	9	13.4

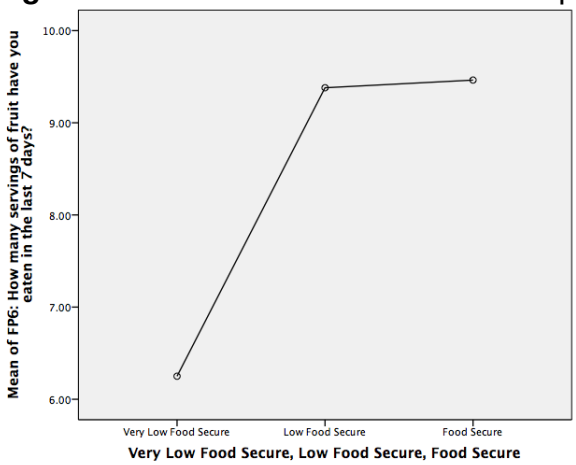
BMI* (Individual)	**Normal**	55	37.4	37	45.6	19	28.4
	Overweight	32	21.8	18	22.2	14	20.9
	Obese	60	40.8	26	32.1	34	50.7

*$p<.05$ (χ^2 statistic)

Fruit and Vegetable Consumption

An ANOVA[80] was used to determine whether participants' weekly vegetable and fruit consumption significantly differed based on household food security status with special consideration for very low food-secure households who are at the greatest risk for experiencing hunger. There was a significant effect of food security status on the number of servings of fruit consumed by participants: $F(2,52) = 3.415$, $p<.05$, $\eta^2 = .20$. Participants living in very low food-secure households reported consuming statistically less fruit (M = 6.25, SD = 6.82) than food-secure households ($M = 9.46$, SD = 7.14, $p<.05$). Since Levene's test was significant, Welch's F is reported for fruit consumption.[81] Low food-secure participants reported consuming an average of 9.38 servings (SD = 10.32). Gabriel's test[81] showed that in this sample the difference in consumption was between food-secure households and very low food-secure households ($p<.05$). The means for fruit consumption by food security status are plotted in Figure 1.

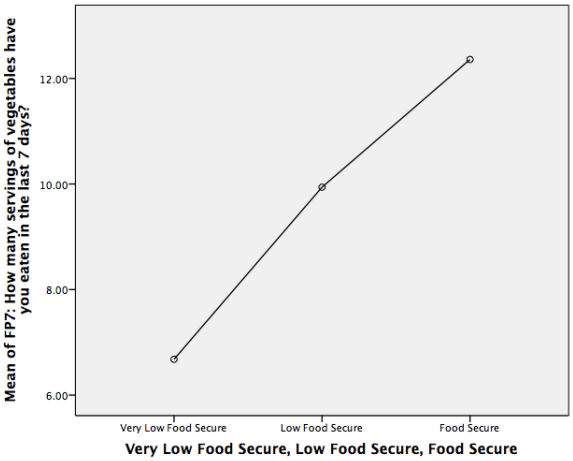
Figure 1. Means Plots for Fruit Consumption



There was a significant effect of food security status on the number of servings of vegetables consumed by participants, $F(2,146) = 8.98$, $p<.001$, $\eta^2 = .33$. Participants living in very low food-secure households

reported consuming statistically fewer vegetables (*M = 6.68, SD = 5.25)* than food-secure households (*M* = 12.36, SD = 7.44), p<.001. Low food-secure participants reported consuming an average of 9.94 servings (SD = 8.44). Gabriel's test[81] showed that in this sample the difference in consumption was between food-secure households and very low food-secure households (p<.001). The means for vegetable consumption by food security status are plotted in Figure 2.

Figure 2. Means Plots for Vegetable Consumption



Food Access and Barriers

In this sample of 151 households with children living in an urban environment, nutrition and prices were very important in regards to influencing household decisions about food choices (Table 3). When less than 10% of participants answered affirmatively to the selected questions for this study, the item was excluded from the table. While a higher percentage of food-secure households valued nutrition (68%), at least half of food-insecure households expressed the same sentiment. However, for food-insecure households, an overwhelming 72% described prices as very important in their decisions about what to buy and where to purchase food. For 27% of food-insecure households, the 2 major barriers to eating the desired food were price and food access concerns related to the distance, travel, and transportation needed to purchase their optimal dietary needs. The majority of participants expressed that the lowest cost foods were at supermarkets, and when asked which food stores were closest to their homes, 72% stated that a supermarket was nearby. However, in the urban area where the research was conducted, the prolific corner stores and convenience stores were evident, with 17% of

participants noting they were the closest food sources. The majority of participants conducted most of their shopping at supermarkets, although 12% of very low food-secure households purchased the bulk of their food at corner stores or convenience stores. When asked about other places where participants shopped for food some of the time throughout the year, differences existed among shopping behaviors of food-secure and food-insecure households. Less than 30% of food-insecure households shopped at specialty stores (e.g., ethnic markets or health food stores), while 55% of food-secure participants shopped at these stores regularly. Around one third of food-secure households shopped at partial markets, while 70% of food-insecure households purchased food some of the time at drug stores, dollar stores, and other mixed retail spaces. Around 60% of food-insecure households purchased food regularly from corner stores or convenience stores, compared to 31% of food secure households.

Consumer satisfaction varied about neighborhood food access overall and the ease of accessing food support services, fresh produce, farmers' markets, produce stands, and inexpensive food. Satisfaction tended to decrease in food-insecure households, with 30% of food-insecure households expressing they were unsatisfied with the ability to access food in their neighborhood. Between 40% and 57% of households found it very easy to find fruits and vegetables in the neighborhood, though access to farmers' markets proved more challenging for food-insecure households. Only 15% of food-insecure households stated it was easy to access a farmers' market in their neighborhood, while 43% of food-secure households found it easy to access one. The concern about price was apparent again when participants were asked how easy it was to find inexpensive food in their neighborhood. Over 37% of food-insecure households stated this was not easy. Around 46% of all households found it very easy to access food support services (e.g., food pantry or community meal).

Table 3. Selected Food Access and Barriers

		Food-secure HH with Children **N = 84**	**Food - insecure HH with Children** **N =67**
		Yes %	**Yes %**

		Food-secure HH with Children N = 84		Food - insecure HH with Children N =67	
		Yes	%	Yes	%
"Very Important" Regarding Food Choices	Nutrition	57	67.9	34	50.7
	Price	34	40.5	48	71.6
Barriers to Food Choices	Distance, Travel, Transportation	2	2.4	18	26.9
	Price	1	1.2	23	34.3
Closest Food Store to Home	Supermarket	61	72.6	48	71.6
	Corner Store or Convenience Store	15	17.9	10	15.0
Food Store Where *Most* Food Is Purchased	Supermarket	77	91.7	58	86.6
Food Store Where *Some* Food Is Purchased	Supermarket	7	8.3	9	13.4
	Partial Market	28	33.3	47	70.1
	Corner Store or Convenience Store	26	31.0	40	59.7
	Specialty Store	46	54.8	20	29.9
Satisfaction with Ease of Food Access in Neighborhood	Not at all satisfied	16	19.0	20	29.9
Very Easy to Find Fruits and Vegetables in Neighborhood		48	57.1	27	40.3

		Food-secure HH with Children N = 84		Food - insecure HH with Children N =67	
		Yes	%	Yes	%
Very Easy to Find Food Support Services in Neighborhood		40	47.6	30	44.8
Not Easy to Find Inexpensive Food in Neighborhood		24	28.6	25	37.3
Very Easy to Find a Farmers' Market or Produce Stand in Neighborhood		36	42.9	10	14.9
Participate in SNAP		18	21.4	46	68.7
Participate in WIC		7	8.3	20	29.9
Participate in Food Pantry	**1-3 x/year**	10	11.9	21	31.3
	4 or more x/year	5	6.0	23	34.3
Participate in Farmers' Market	**1-3 x/year**	18	21.4	16	23.9
	4 or more x/year	45	53.3	16	23.9
Participate in Personal or Community Garden		46	54.7	15	22.4

This research was also interested in residents' participation in public and private food programs, in part to provide a baseline to community partners and public agencies interested in testing interventions to improve food security, nutrition, food access, and health outcomes. Around 69% of food-insecure households participated in SNAP, while 30% of food-insecure households participated in WIC. In addition, 34% of food-insecure households obtained food from a food pantry at least once each month, while 31% accessed a food pantry between 1 and 3 times during the year. Only 18% of food-secure households obtained food from

pantries, with most accessing them intermittently. While visiting a farmers' market was common for food-secure and food-insecure households, food-insecure households reported less frequent visits to markets overall, with only 24% purchasing food more than 4 times during the past year. More food-secure households purchased food at a farmers' market 4 or more times during the year. Food-secure households were much more likely to participate in a personal or community garden than food-insecure households, though 23% of households with children who were food insecure obtained food from a garden during the past year.

Discussion

This study revealed a serious concern about food insecurity in households with children in an urban environment. In this study, 44% of households with children under the age of 18 were considered food insecure, which is much higher than Franklin County estimates of food insecurity (18%) and child food insecurity rates (23%).[2] Even more alarming, of food-insecure households, 62% were very low food secure (or at risk for experiencing hunger). Adults in households with children often modify their diets in order to ensure their children do not suffer from hunger.[3,21,82] Even if the children were not experiencing hunger themselves, the impact of parents or caregivers experiencing hunger is likely to affect the household. Household food insecurity contributes to increased familial stress; food-insecure adults with low energy levels related to stress can impact the ways they engage with children.[83-85] Though mental health was not directly measured in this study, food-insecure women are more likely to experience stressful life events, depression, low self-esteem, and low levels of self-efficacy.[87,88] Household stressors include the challenges of finding accessible inexpensive food and healthy food. This study showed that for all households nutrition is very important, but ultimately the cost of food is the highest priority when making food purchases for food-insecure families. Food-insecure households are faced with tensions when making food purchasing, preparation, and consumption decisions. These monthly decision-making practices contribute to feelings of anxiety about having enough food to provide a nutritionally adequate diet.[89]

Nutritional deficiencies impact psychological well-being.[88, 90-92] In our study, weekly fruit and vegetable consumption was low for the entire sample. The significantly lower intake of nutrient-dense fruits and vegetables for food-insecure households is of the greatest concern. In the US, it is recommended that adults eat between 1.5 cups and 2 cups of fruit each day and 2 to 3 cups of vegetables each day, amounting to 10.5-14 cups of fruit each week and 14-21 cups of vegetables each week.[93]

Participants were given cues about serving sizes during the survey, using pictures and descriptions on a large card (e.g., 1 serving of fruit = ½ cup dried fruit or 1 medium piece of fresh food; 1 serving of vegetables = 1 cup of raw or cooked vegetables, 2 cups of raw leafy greens or salad). On average, very low food-secure households consumed less than 1 serving of fruit each day and only 8 servings of vegetables each week. Dietary quality is often measured using produce intake as a proxy; research has shown direct links between diet quality and depression.[94-97] Researchers have found that increased dietary quality decreased the odds of psychological disorders and poor mental health, though more research needs to be conducted to determine the dose response of fruits and vegetables.[98] High levels of phytochemicals in fruits and vegetables and anti-inflammatory micronutrients, like magnesium, may reduce stress and improve psychological well-being.[99-101] Children in food-insecure households may also experience nutritional deficiencies related to poor produce intake while modeling their caregivers' dietary patterns, putting them at an increased risk for mental and physical health problems.[102,103]

Improving diet and managing psychological and environmental stress can positively impact health and reduce the likelihood of experiencing a chronic disease.[104-108] The concomitant physical health problems that accompany mental health concerns in food-insecure households compound the potential impacts on the long-term burdens faced by households struggling to meet their dietary needs for a healthy lifestyle. In our study, approximately 25% of food-insecure households had not seen a health professional in the last year, so it is likely that self-reported health conditions are underreported. The prevalence of overweight and obesity in the US is around 69%.[109] This is less than reported by our total sample (62.6%), but when food security status is considered, 72.7% of food-insecure participants were categorized as overweight or obese. Nearly 52% of food-insecure households were considered obese, compared to 32% of food-secure households. The high number of obese individuals is of great concern, as it is statistically higher than that of the US overall (35%).[109] While 9.3% of the US population has type 2 diabetes,[110] our results indicated that 23% of food-secure households and 28% of food-insecure households report presence of type 2 diabetes or prediabetes in a household member. Across the US, nearly 28% of people with diabetes are undiagnosed;[105] this is important, considering the number of participants in our sample who had not seen a health professional in the past year. High blood pressure is a risk factor for chronic disease and may also be an indicator of environmental stress. Nationally, around 33% of adults experience high blood pressure,[111] while

our findings show higher rates in food-insecure households (35.8%). Lastly, cancer rates in our sample are higher in food-insecure households; these rates may be linked to dietary consumption or environmental factors. Our study is limited since we do not know the type of cancer or which member of the household was diagnosed with cancer. This limits comparisons because of different incidence and prevalence rates of cancer based on gender, age, and risk factors (e.g., smoking, physical activity, and genetics).[112]

Implications for Policies and Programs

For low-income households, higher rates of physical and mental health issues contribute to a significant public health burden, especially related to disabilities.[4,113-115] Additional challenges exist when designing interventions for food-insecure households struggling to find accessible, affordable nutritious food in their food environments. These complex issues must be simultaneously addressed at multiple systems levels, which includes consideration of local, state, and federal policies and programs that focus on food and nutrition security. Combining multiple strategies inclusive of social justice, public health, sustainability, and poverty is warranted. In this section, we discuss our findings in the context of policies and potential intervention strategies specific to our community.

Our findings suggest that people experience their food environment unequally. Nearly 30% of our respondents were not satisfied with neighborhood food access, citing transportation, distance to stores (27%), and price (34%) as barriers to having an optimal diet. Price was very important to 72% of food-insecure households. Most participants stated that supermarkets and grocery stores had the lowest prices. Nearly 69% of food-insecure households participated in SNAP and redeemed benefits at supermarkets. Though supermarkets and grocery stores were often not located in the urban environments where participants lived, they shopped there because they were SNAP-authorized retail outlets and because prices were perceived to be lower. Though corner stores, convenience stores, and partial markets were nearby, they were not used for the majority of food purchases. When asked about regular food purchases beyond supermarkets, 70% of food-insecure households said they purchased food at partial markets, and nearly 60% bought food at corner stores that are prolific in urban neighborhoods in this study.

Though people with SNAP stated they redeemed that at supermarkets, further analysis of shopping behaviors showed that 67% of food-insecure participants with SNAP benefits shopped at partial markets, and 79% of food-insecure participants with SNAP shopped at corner

stores. Of the 8% of participants with WIC, 67% purchased other food sometimes at corner stores or convenience stores, and 76% purchased food at partial markets. While the majority of SNAP and WIC benefits were used at supermarkets, participants rounded out their monthly food purchases outside of their SNAP benefits at more convenient neighborhood locations where prices may be higher and choices limited.

From a policy standpoint, it is important to consider where food-insecure households with WIC and SNAP buy food. First, policy advocates understand that for many households with WIC and/or SNAP, it is more convenient to purchase some food at partial markets and corner stores. Consideration must be made concerning WIC and SNAP authorization at food stores in neighborhoods. Retailers interested in becoming WIC-authorized retailers do so through an application through that retailer's state agency sponsoring WIC. In the state where this study took place, the agency is the state Department of Health. Retailers apply through the agency for a contract of 3 years in different categories, including retail, retail/pharmacy, pharmacy, or farmer.[111] (Partial markets, in our study, include pharmacies that have some food available.) Since WIC is focused on nutrition, vendors must have the appropriate type of food and amount of food required for participation, along with completion of paperwork. A maximum number of vendor contracts are available in each county for retail and pharmacy vendors.[116] To become a SNAP-authorized retailer through the USDA, stores must offer at least 3 varieties of each staple food group—breads and grains, dairy, fruits and vegetables, and meat, poultry, and fish or have more than half of all sales come from the sale of those staple products.[36] Vendors complete an online application and pay for their own Electronic Benefit Transfer (EBT) equipment.[117] Advocates could work with store owners to determine eligibility, assist with filing paperwork, communicate with the appropriate state or federal office, help stores meet requirements by documenting current sales, evaluate current food offerings, and assist with marketing and signage to engage WIC and SNAP participants. WIC policy advocates should evaluate the reasons why a limited number of contracts are available to determine whether this is best serving low-income residents.

Healthy corner store programs are a second type of intervention related to increasing access to affordable food. Food-insecure households have a hard time finding fresh fruits and vegetables near where they live, often shop at partial markets and convenience stores, and have extremely low weekly intake of vitamin-rich fruits and vegetables. Programs like Fresh Foods Here (FFH) work with local corner stores to increase the availability of fruits and vegetables, whole grains, low-fat dairy, and low-

sodium snacks. This includes improvements to the storefronts, improved marketing and signage, improved lighting, better shelving, new refrigeration units, and technical assistance with product placement.[72] FFH has expanded its program to other low food access areas in the city where this study took place. The program has also implemented a more extensive evaluation plan to identify programmatic impacts like consumption of healthy foods, improved nutrition knowledge, increased patronage and sales, and appropriateness of partnerships with corner stores. Our data reflect the opportunity that exists in our community for a corner store initiative to have an impact. Based on our data, it is evident that this type of initiative should also be extended to partial markets (e.g., dollar stores) as these are easily accessible, commonly used food sources for low-income residents and prolific in many of the urban neighborhoods that have limited or no access to grocery stores in our area.

In our study, food-insecure households were hard-pressed to find a farmers' market or produce stand in the neighborhood, while 43% of food-secure households found it easy to shop at a farmers' market in their neighborhood. Though our study does not show causality, food-secure households shopped more regularly at these markets and did not feel that distance, transportation, or price limited their food choices. Contributing factors as to whether food-insecure households accessed a farmers' market and how often they participated are likely due to aforementioned barriers of distance, travel, transportation, price, and whether the markets accepted WIC or SNAP. Farmers' markets are important access points for increasing dietary consumption of fruits and vegetables and improving public health outcomes.[116,118,119] Programs like the Senior Farmers' Market Nutrition Program (SFMNP) and WIC Farmers' Market Nutrition Program have been described as community food security strategies because they can both improve healthy food access for low-income consumers and support smaller-scale farmers; this approach keeps money circulating in the local economy. The SFMNP is managed through a partnership between the state Department of Aging and area agencies that serve seniors, while the WIC FMNP is managed by the state Department of Health, while. Adults who shop regularly at farmers' markets through these programs have the potential to increase fruit and vegetable consumption, thus improving physical and mental health, and for modeling healthy food practices for their children. Though our study sample of households with children did not include any seniors eligible for the SFMNP, advocates should work in their communities to develop these programs while they have been authorized through the Agricultural Act of 2014[35] and consider ways to promote program participation. Similarly, advocates should

ensure that people with WIC vouchers are knowledgeable about the WIC FMNP and where the coupons can be used. Since our data show barriers to healthy food include transportation, distance, and travel, it is necessary to consider how to decrease these barriers for WIC participants to easily engage in a market that accepts the FMNP vouchers. Advocates must work with producers to increase awareness about the FMNP program, which seeks to assist small-scale farmers with increasing patronage and sales. Lastly, in multigenerational households where seniors may be present, the SFMNP may be an option to improve the availability of healthy foods to help offset the limited food budgets of low-income households.

Persons with SNAP benefits may also participate in programs that help stretch food budgets for households limited by price and food availability. In March 2015, USDA announced $31 million in grant support for pilot projects through the Food Insecurity Nutrition Incentive Program as part of the Food, Conservation, and Energy Act of 2008.[36] These projects ranged from short-term pilot projects to multi-year, community-based and large-scale projects.[120] In our community, a program was expanded that allowed for consumers with SNAP benefits to double their benefits up to $20 at approved markets and produce stands. This project was supported by a unique private-public partnership that included the city, county, producers, community agencies, farmers' markets, and a large national charitable foundation that sponsors programs that incentivize local food systems and make fruits and vegetables more affordable.[121] During its first year, around 300 people participated and purchased $5000 worth of produce. It has now expanded to 9 markets in the area and has increased its marketing to help make it easier to participate. This is another program that recognizes the role food plays in people's lives and the impact incentivizing locally grown fresh produce can have on consumer health, producer income, and community building.[124] The foundation that sponsors our city's program is in line with CFS strategies that provide increased opportunities for knowledge exchanges between farmers and consumers and support long-term strategies to improve a community's well-being.

In 2015, the USDA also announced that SNAP benefits can be used to purchase Community Supported Agriculture (CSA) shares—or weekly produce boxes.[123] CSAs have not been accessible for low-income people because money for CSA shares is usually collected at the start of a growing season and covers 10 to 20 weeks of produce. Participants share in the risk of food production alongside the farmers and other participants. Low-income households may not have the cash or money upfront to

participate, so this new program allows for persons with SNAP to work with authorized producers to use their benefits and pay at shorter time intervals (e.g., monthly). In our city, an extremely impoverished urban Appalachian neighborhood of 12,000 people houses a 2-acre urban farm. This urban farm is piloting the use of SNAP benefits with its CSA program, and the farm received a small local grant to provide subsidized low-cost shares to low-income residents. The farm has implemented evaluation procedures to gauge the impact on consumption, community engagement, and participation in other complementary programs (e.g., FMNP, Veggie SNAPS). Advocates should increase awareness about these innovative programs, ensure that transportation and cost are addressed to decrease barriers, and engage with residents about potential long-term benefits. These benefits may include increased self-efficacy, stronger relationships with community members, increased knowledge about food production, and shifts in dietary purchasing and consumption patterns favoring healthy food. All of this would eventually impact children in the household.

Results of our study show that gardening and food pantries are 2 other food access points for households with children. This study showed that food-insecure households rely on food pantries to meet their food needs on a regular basis, with over 24% of food-insecure households visiting a food pantry more than 4 times each year. Though this is not generally seen as a CFS strategy, but rather an emergency food assistance effort with which CFS programs should work in conjunction, food banks across the US have initiated several programs that seek to reduce waste of fresh produce, engage residents in food production, and improve consumption of healthy foods. For example, Grow Well Missouri connects gardeners with food pantries, shelters, and community meal programs to help facilitate donations of fresh food. This program has also piloted gardening education programs and seed distribution at food pantries to help pantry clients grow some of their own food. In addition, it has formed pantry-based wellness groups to address community nutrition and health needs.[124] These programs work to reduce food waste from produce left in the fields, increase self-reliance for individuals and communities, improve knowledge of food production, and improve social networks. Gardens, whether facilitated through pantries, organizations, grassroots efforts, or within families, can promote improved health through greater consumption of fresh fruits and vegetables, increased physical activity, and even psychological well-being.[7, 124] Community gardens can increase social capital,[122] which is paramount to low-income households that live in low-resource communities. Advocates and practitioners should explore ways in which gardens can be a tool for public health by

evaluating consumer interests regarding food production, finding available land, and equipping gardeners with the information, tools, seeds, and utilities needed to grow food together. Policy advocates should work with local government to address policies related to food production, land tenure, and zoning laws that impact whether food can be sold from noncommercial properties.

Conclusion

This study of 151 households with children across a diverse geographic area within a large metropolitan midwestern city provides detailed results regarding household food security, food access and barriers, dietary intake, and health. We outlined ways in which food insecurity, barriers to food access, and low fruit and vegetable intake can impact the physical and mental health of adults and children in food-insecure households. Lastly, we explored how community food security strategies developed through public, private, federal, state, and local partnerships can impact a community by decreasing food insecurity, increasing consumption of healthy and local food, and improving economic opportunities. By creating healthier communities, children will be able to thrive and positively contribute to the world.

Table 4. Public Food Assistance Programs

Program	Website	Description	Eligibility Requirements
Fresh Fruit and Vegetable Program	http://www.fns.usda.gov/ffvp/fresh-fruit-and-vegetable-program	Provides free produce to students in participating schools.	Targets schools with the highest free and reduced-price meal enrollment.
National School Lunch Program (NSLP)	http://www.fns.usda.gov/nslp/national-school-lunch-program-nslp	Provides children with nutritionally balanced meals each school day.	Children at ≤130% poverty level for free meals. Children between 130-185% poverty level are eligible for reduced-priced meals.
School Breakfast Program (SBP)	http://www.fns.usda.gov/sbp/school-breakfast-program-sbp	Participants receive breakfast that meets the Dietary Guidelines standards.	Children at ≤130% poverty level to be eligible for free meals. Children between 130-185% poverty level are eligible for reduced-priced meals.
Child Nutrition USDA Foods Program	http://www.fns.usda.gov/fdd/food-distribution-programs	Provides cash reimbursements to American agricultural producers for meals served in school; provides USDA-purchased food to the National School Lunch Program, the Child and Adult Care Food Program,	Schools participating in the NSLP or institutions participating in the CACFP or SFSP are eligible to receive USDA-donated commodities.

Program	Website	Description	Eligibility Requirements
		and the Summer Food Service Program.	
Commodity Supplemental Food Program	http://www.fns.usda.gov/sites/default/files/pfs-csfp.pdf	Supplements the diet of elderly persons by providing nutritious USDA foods.	Participants must reside in one of the states or Indian reservations that participate. Elderly participants must meet income limits that are ≤130% Federal Poverty Income Guidelines. Limits for women, infants, and children who remain on the program ≤185% of the Federal Poverty Income Guidelines but not below 100% of the guidelines.
Supplemental Nutrition Assistance Program (SNAP)	http://www.fns.usda.gov/snap/supplemental-nutrition-assistance-program-snap	Assistance to purchase foods for the household to eat.	Must meet a test of monthly gross income and have net income below the poverty line; the total liquid assets of a household must be ≤$2,000 ($3,250 for seniors and the disabled), and the fair market value of one car per adult household member must be ≤$4,650.
Supplemental Nutrition Program for Women, Infants	http://www.fns.usda.gov/wic/women-infants-and-	Provides supplemental nutritious foods, nutrition education and counseling	Pregnant women through pregnancy and ≥6 weeks after birth, breastfeeding women, non-

Program	Website	Description	Eligibility Requirements
and Children (WIC)	children-wic	as well as screening and referrals to other health related services.	breastfeeding postpartum women ≥ 6 months post-birth, infants up to their first birthday and children ≥5th birthday, with an income at or below an income level or standard set by the state agency and who are at nutritional risk as determined by a health care professional.
WIC Farmers' Market Nutrition Program	http://www.fns.usda.gov/fmnp/wic-farmers-market-nutrition-program-fmnp	Provides fresh, unprepared, locally grown fruits and vegetables to WIC participants. A variety of fresh fruits and vegetables can be purchased with FMNP coupons.	Women, infants (≥4 months old), and children who have been certified to receive WIC program benefits or who are on a waiting list for WIC certification are eligible to participate.
Senior Farmers' Market Nutrition Program	http://www.fns.usda.gov/sfmnp/senior-farmers-market-nutrition-program-sfmnp	Provides grants to states to provide low-income seniors with coupons to purchase foods such as fruits, vegetables, honey, and herbs from farmers'	An applicant's gross household income must be ≤185 percent of the US Poverty Income Guidelines.

Program	Website	Description	Eligibility Requirements
		markets, roadside stands, and community-supported agriculture programs.	
Expanded Food and Nutrition Education Program (EFNEP)	http://nifa.usda.gov/program/expanded-food-and-nutrition-education-program-efnep	Operates through land-grant universities and offers nutrition education to limited-resource families and children.	Individuals who are responsible for feeding their children and are eligible for any assistance program such as WIC, SNAP, or Head Start are eligible for EFNEP.

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