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Increasing Low-income Residents' Access to Fresh Produce through a Local Mobile Pantry

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Abstract

Seeds that Feed (STF) is a mobile food pantry located in Fayetteville, Arkansas. STF receives produce from local farmers to distribute to residents in low-income housing sites throughout Northwest Arkansas. According to Feeding America, food insecurity affected 14.3% Washington County, Arkansas' population in 2016. The purpose of this study was to determine if STF's model is an effective way to increase individuals' access to fresh fruits and vegetables and increase their potential to meet the United States Department of Agriculture's Food Patterns (USDA-FP) for to fruit and vegetable consumption. Twenty-three participants from three sites completed the study. A survey was used to collect basic demographics and dietary patterns. Record was taken of what foods each participant received on the survey day including plans for preparation and to whom it would be served. All anonymous responses were statistically analyzed using Excel. The results indicated that the likelihood to meet the USDA-FP for overall fruit and vegetable intake increased significantly after receiving approximately one cup of fruit and 1 ½ cups of vegetables from STF. A positive correlation was found between the number of times participants received produce from STF and participant's total fruit intake and total intake of the "red/orange" and "other" vegetable subgroups. Therefore, STF's model appears to be an effective method to increase access to fresh produce. Future research could utilize STF's model to assess the potential for other supplemental nutrition programs to help low-income residents meet the USDA-FP and reduce food insecurity via mobile pantry.

Introduction and Literature Review

Literature Review

A universal definition for a food desert and for food insecurity has yet to be established; however, many can agree upon the alarming number of food deserts and the presence of food insecurity in the United States. According to the United States' largest domestic hunger relief organization, Feeding America, 12.9% of Americans were food insecure in the year 2016 (Feeding America, 2018). That number translates to over 41 million people in the United States. Nunnery et al. define food insecurity as “the condition of inconsistent or uncertain availability of safe and nutritiously adequate food” (Nunnery et al., 2018). Similarly, the United States Department of Agriculture (USDA) defines food insecurity as “disrupted eating patterns and reduced food intake” (USDA, 2017).

Food insecurity stems from a multitude of factors including income, socio-economic status, race, location, and access to transportation—just to name a few. Similarly, food deserts are defined by the USDA as a community where the poverty rate is above 20% and at least one third of residents in urban communities live one mile from a grocery store and ten miles in rural communities (Dutko et al., 2012). The USDA considers low-income status to be a distinctive characteristic of residents in food deserts (Dutko, et al., 2012; Strome, et al., 2016; Singleton et al., 2017). Income influences food purchases and as a result, personal health; therefore, a strong link between income, diet, and personal health can be observed in the United States (Tsang et al., 2011; Strome et al. 2016; Singleton et al., 2017). Over time, income has become an indicator for predicting dietary patterns. Low-income status is commonly associated with a diet greater in energy-dense, highly processed foods with little nutritive value while a higher income is associated with consuming more fruits and vegetables. (Nunnery et al., 2018). Multiple studies

conclude that income is often the limiting factor preventing low-income status populations from purchasing enough fruits and vegetables to meet the Dietary Guidelines for Americans (DGA) set by the USDA (Zepeda et al., 2014; Nunnery et al., 2018).

For years, the USDA's DGA have considered fresh fruits and vegetables as part of a nutritious diet (USDA, 2015). The 2015-2020 DGA emphasize a variety of fresh vegetables from all of the vegetable subgroups and fresh fruits as a part of a nutritious diet. Vegetables are divided into five subgroups based on their varying nutrient profiles; these subgroups are: dark leafy greens, red and orange vegetables, other vegetables, starchy vegetables, and beans and legumes. According to Strome et al., regular consumption of *fresh* fruits and vegetables reduces that risk of chronic illness (Strome et al., 2016). The USDA has also developed the USDA Food Patterns (USDA-FP) in order to assist individuals in meeting the recommendations set by the 2015-2020 DGA in their daily life. According to the USDA-FP, to meet the dietary needs of a 2000 calorie diet, a person must consume 2 ½ cups of vegetables and 2 cups of fruit daily (USDA, 2015). Therefore, a 2,000 calorie diet was chosen as the standard diet for this research. This is also based on the Daily Value measurement of 2,000 calories set by the US Food and Drug Administration (FDA).

Only about one fourth of the population meets these recommendations for fruits and vegetables putting the nation at a deficit for fruit and vegetable intake (USDA, 2015; Okeke, et al., 2017). A study conducted by Phillips et al. found that about 20% of low-income status families in the United States don't even purchase fruits and vegetables (Phillips et al., 2013). A more recent study found that income was a significant predictor of fresh fruit and vegetable consumption which further supports that income affects dietary patterns and as a result, health (Strome et al., 2016). Low-income status often results in a diet rich in non-nutritive foods and

low in fresh fruits and vegetables and as a result, chronic illness such as diabetes, heart disease, kidney disease, and certain cancers (Widener et al., 2014; Freedman et al., 2016). In the Journal of the Academy of Nutrition and Dietetics, one article stated that “low-income individuals are disproportionately affected by food access barriers that result in increasingly disparate diet quality” (Freedman et al., 2016). In order to address health disparities as a result of low-income status and poor diet, The Institute of Medicine has concluded that is critical to address food insecurity within low-income populations (Institute of Medicine, 2011; Nunnery et al., 2018)

Racial minority also appears to be a characteristic of food desert residents and a predictive factor for food insecurity. Supermarkets and large grocery stores with a wide variety of affordable and nutritious food options, notably, fresh fruits and vegetables, are less likely to be found in urban and rural minority neighborhoods (Morland and Filomena, 2007; Freedman, 2009; Krukowski et al., 2010; Dunn et al., 2011; Gebaure and Laska, 2011; Widener et al., 2012; Schlundt et al., 2017; Singleton, et al., 2017). The number of small food stores and convenience stores often outnumber the number of large grocery stores in areas of high food insecurity; they tend to be stocked based on the socio-demographic characteristics in the surrounding community such as African-American, Hispanic, single-mother household, etc. (Morland and Filomena, 2007; Freedman, 2009; Strome, et al. 2016; Schlundt, et al. 2017).

Most food stores in low-income, minority neighborhoods are convenience stores with little to no fresh, affordable produce available (Morland and Filomena, 2007; Franco et al., 2008; Widener et al., 2012; Hosler and Kammer, 2015). Research by Strome et al. concluded that “economically deprived areas have trouble attracting supermarkets, and when they do, their selection of healthy foods is often diminished” (Strome et al., 2016). Yet, many of the small convenience stores in areas of low socio-demographic/economic status provide food in between

grocery store visits and/or serve as the sole source of commercial food for a community.

Therefore, understanding the obstacles these stores face in stocking fresh produce could influence the way intervention programs operate (D'Angelo et al., 2017). Stores select their stock based on profit gained and ease of storage. In multiple studies, small store owners expressed that, despite their desire to sell fresh produce, they experienced difficulty storing and making a profit from fresh produce (Hosler, 2015; Caspi et al., 2016; D'Angelo et al., 2017; Okeke et al., 2017). In summation, convenience stores struggle to profit from fresh produce sales while residents cannot afford the price of produce sold in these stores further exacerbating the disparity of fresh, affordable produce available in low-income communities (Widener et al., 2012; Okeke et al., 2017).

In a multitude of studies focusing on the availability of fresh fruits and vegetables in convenience stores, researchers found a shocking lack of fresh fruits and vegetables in stores relative to the abundance of energy-dense, sugary foods and beverages, alcohol, and tobacco products. Among all of the studies reviewed for this article, only about 50% of stores from each study sold fresh fruits and vegetables, and in many studies, less than 10% of stores assessed sold fresh fruit or vegetables—yet, many of these places were the only food store in its community. In each case, the amount of energy-dense, sugary foods and beverages, alcohol, and tobacco products strongly outnumbered the healthful food options available. (Freedman, 2009; Ethan et al., 2013; Caspi et al., 2016; D'Angelo et al., 2017; Singleton et al., 2017). In one particular study on the healthful foods and resources at 16 truck stops across the United States, researchers concluded that in general, truck stops do not aid in providing customers with healthy living options and healthy food choices on the go. In terms of diet alone, the truck stops in this study did not aid its customers in meeting the USDA-FP recommendations (Lincoln et al., 2018).

These findings are relevant to this study since truck stops also function as small convenience stores in most communities. In another study conducted by Freedman, participants who lived in areas with a high prevalence of convenience stores and no large grocery stores reported that “there were *no* food stores in their community,” revealing that interviewees did not consider the local convenience stores to be ‘real’ food stores” due to the lack of affordable, healthful foods available (Freedman, 2009). Among all the studies reviewed for this article, when produce was available at convenience stores it was overpriced, poor quality, and/or relatively low in nutrients (Morland and Filomena, 2007; Freedman, 2009; Hosler et al., 2015; Strome et al., 2016; Lincoln et al., 2018). For example: dark, leafy green vegetables have become decreasingly available over the years in these small food stores (Hosler et al., 2015). This issue of disproportionate non-nutritive to nutritive stock is intensified by the similar disproportionate of grocery stores compared to the abundance of convenience stores in food deserts and low-income communities (Singleton et al., 2017). In addition, one study conducted by Ethan et al. found that food store circulars in the Bronx area, where a large portion of the United States diabetic population lived at the time, had far more deals and ads for non-nutritive foods on the front pages. This type of promotion and advertising, as well as the competitive price of nutrient-deficient, energy-dense foods further exacerbates the problem at hand (Ethan et al. 2013).

Likewise, the price of produce, when available at convenience stores, tends to be priced higher than it would be at a grocery store or super market. This trend is yet another factor that promotes food insecurity and lower fruit and vegetable consumption in low-income, minority communities. (Freedman, 2009; Krukowski et al., 2010; Dunn, et al., 2011; Strome et al., 2016) These findings are relevant as communities characterized by lower socio-demographic and economic status are already at a higher risk for chronic illness due to environmental reasons and

poor diet (Krukowski et al., 2010; Tsang, 2011; Nunnery et al., 2018). Factors such as demographic, price, and availability are just some of the factors that limit the consumption of fresh fruits and vegetables in food insecure communities (Strome et al., 2016). Regular consumption of fruits and vegetables that meet the recommendation set by the USDA largely influence the progression and prevention of chronic illness; therefore, intervention programs that focus on providing consistent access to affordable, nutrient-dense produce is of utmost concern for the health of our nation (USDA, 2015; Strome, et al, 2016; Nunnery et al., 2018).

Improving access to fruits and vegetables is a primary factor for increasing fresh fruit and vegetable consumption. While quality and affordability remain important factors, produce must first be available before one can consider price and quality. Therefore, transportation must be recognized as a barrier to access fresh produce (Dunn et al., 2011, Tsang et al., 2011). An individual may live within a few miles of a large grocery store, but not having a car limits the quantity one can purchase in a single trip (Strome et al., 2016). Mobile pantries have been proven to minimize the gap between residents and available produce. Widener and colleagues found that they were able to reduce residents' travel distance from over one mile to less than half a mile with the use of mobile pantries (Widener et al., 2012). This study also developed a systematic method to identify areas of lowest income and produce availability which may be an effective tool for other mobile pantries to adopt. The use of mobile pantries also serves as a viable alternative to a brick and mortar store in low-income areas where business owners consider produce sales to be unprofitable (Widener et al., 2012; Zepeda et al., 2014; Caspi et al., 2016). Just as store owners want to make a profit, all shoppers, especially those of low-income status, look for bargains. With roughly 20% of low-income Americans not purchasing produce at all, produce must be made affordable (Widener et al., 2012; Phillips, et al., 2013; Zepeda, 2014).

In multiple studies, the use of a mobile pantry to distribute discounted produce to food insecure, low-income neighborhoods increased residents' consumption of fresh fruits and vegetables (Zepeda, 2014; Hosler and Kammer, 2015).

Each community differs in its demographics and barriers; therefore, solutions to increase access to fresh fruits and vegetables must be tailored to its population (Strome et al., 2016). In multiple studies of similar focus, researchers and participants alike have referenced mobile food pantries as a method to increase fresh fruit and vegetable consumption in a diverse array of low-income, food insecure areas (Larson et al., 2013; Hosler et al., 2015; Strome et al., 2016).

In this study, researchers observed the work of a local mobile pantry, Seeds that Feed (STF), in order to determine its effectiveness in Northwest Arkansas. In the state of Arkansas, the rate of food insecurity was at 17.2% in 2016 and in Washington County, 14.3% while the national level sat at 12.9% making Arkansas a primary target state for food insecurity intervention (Feeding America, 2018). Since the USDA considers income to be a distinguishing characteristic of residents in food deserts, income in Washington County must be highlighted before moving forward (Dutko, et al., 2012; Strome, et al., 2016; Singleton et al., 2017). In Washington County in the year 2016, 59% of residents were eligible for SNAP (Supplemental Nutrition Assistance Program) benefits, one of the largest supplemental nutrition programs (SNP) in the nation designed by the USDA. Another 18% of residents qualified for other SNP assistance meaning that over three quarters of residents in Washington County were eligible for food assistance in relation to income (Feeding America, 2018). STF identified multiple low-income housing sites across Northwest Arkansas to deliver fresh produce to its food-insecure residents. STF delivers produce through a mobile pantry which allows them to reach multiple sites beyond what a brick and mortar store could accomplish. Since 2012, STF has donated over

120,000 pounds of fresh produce and 20,000 pounds of recovered food and their impact is still growing (Seeds That Feed, 2018).

Problem Statement

In Washington County, food insecurity affected 14.3% people in 2016 and as a result, many individuals struggled to obtain sufficient fruits and vegetables to meet the USDA-FP recommendations (Feeding America, 2018). Researchers observed a local food pantry, Seeds That Feed, whose primary mission is to distribute fresh produce across Northwest Arkansas, in order to determine if their model is an effective way to increase access to and intake of fresh produce in a food insecure region. The results will be used by Seeds that Feed to improve their services by distributing produce based on dietary deficits observed in the study. Deficits will be compared to participants' demographics in order for Seeds that Feed to target specific dietary needs of various populations in Washington County.

Seeds that Feed

STF is a mobile food pantry based out of Fayetteville, Arkansas that delivers fresh produce to food-insecure communities across Washington County and the rest of Northwest Arkansas. STF receives produce from farmers and some food stores in Northwest Arkansas who have agreed to donate a portion of their produce and other food items to STF. STF has partnered with multiple low-income housing complexes in Northwest Arkansas to regularly distribute produce at no cost to the housing residents. All residents at these sites are eligible to receive produce donations. At this time, no limit is set regarding the amount of produce a single participant can receive in donations.

Research Objectives

1. Determine if there is a correlation between demographic (income, race, and region of residence in Fayetteville) and amount of fresh produce consumed by this population before participating in this study
2. Determine if Seeds that Feed's mobile pantry is an effective way to increase access to fresh produce and increase potential intake of fresh produce for food insecure residents in Northwest Arkansas
3. Determine if the number of times a participant has received donations from STF positively correlates with their consumption of fresh produce
4. Determine if the number of SNP used by individuals positively correlates with their consumption of fresh produce

Materials and Methods

Survey Design and Distribution

A one-time survey was distributed to participants at three separate donation sites on three separate days. The researchers accompanied STF staff to distribution sites where participants were allowed to take as little or as much produce as they wanted at no cost. Participants were approached after they had collected their goods and were asked to take the survey after receiving a full explanation of the survey and giving their verbal consent. Respondents used iPads to complete the survey after collecting produce. Assistance with use of the iPad was offered to those with impaired vision and/or impaired fine motor skills.

Data collected included: basic demographics including race, age, gender, income, and what region of residence in Fayetteville. STF operates primarily throughout the city of Fayetteville in Northwest Arkansas. Therefore, participants were shown an image of the city of

Fayetteville divided into 4 quadrants (West Fayetteville, Campus Corridor, East Fayetteville, South Fayetteville) and asked to indicate which quadrant they lived in or whether they lived outside of Fayetteville. Data collected also included a food frequency record, and how frequently returning customers received produce from STF. Participants were also asked to indicate where they shopped for food, what barriers they face when trying to access food, and what, if any, SNP they used. Lastly, participants were asked to specify what produce they received on that day and how they intended to prepare it and for whom in their household.

The survey was used primarily to determine each individual participant's average dietary intake in relation to the USDA-FP for their age and gender. This data revealed participants' average dietary intake of fruits, vegetables, and vegetable subgroups as well as the potential possible increase in their dietary intake of fruits, vegetables, and vegetable subgroups after receiving the produce from STF.

Participants and Sampling

Participants were recruited during three separate mobile pantry drop-offs. The number of recipients at each drop-off site ranged from 10-30 people. Participants were considered eligible for the study after collecting produce from STF and were recruited on a volunteer basis resulting in a convenience sample of 24 participants total; however, data from one participant was excluded due to nonsensical responses resulting in 23 participants at the end of the study. The breakdown of participants and sites are delineated below:

- Eight participants from a senior citizen assisted-living apartment complex
- Seven participants from low-income family housing⁵

⁵ the excluded participant was originally surveyed at this location

- Eight participants from the Women, Infants, and Children (WIC), all of whom were first-time recipients

Roughly half (52%) of the participants were of minority status. This entire sample was comprised of 26%, 17%, and 9% Hispanic, African American, and/or other, respectively.

According to the Poverty Guidelines determined by the United States Department of Health and Human Services, 56% of participants fell below the poverty line for their household size (USDHHS, 2018).

Two of the observed sites had consistently received donations from STF preceding this study. No incentive was offered at the first two locations (the senior citizen assisted-living apartment complex and the low-income family housing). Because most of the participants from the first two locations were returning customers, these participants were informed in advance that STF would be conducting a survey at the visit and that their participation was a way to “return the favor” to STF and help STF serve them better. However, it was made clear to all participants there were no penalties for not participating. WIC and its members had no prior relationship with STF leading up to this study. Therefore, the participants at the WIC location had never received donations from STF prior to this study. Participation was completely voluntary and thus, participants were able to exit the survey at any time without any consequences.

Data Collection

All data was collected through the survey via the application, Qualtrics, on iPads. Participants were given the iPad to complete the study independently. Assistance was offered to those with impaired vision and/or impaired fine motor skills. These responses were given verbally and entered by one of the researchers or volunteers. All data was recorded and interpreted in Excel.

Data Analysis

Data was analyzed in six key areas to meet the objectives of this study:

- Determine the relationship between demographic (income, race, and region of residence in Fayetteville) and overall fruit, overall vegetables, and vegetable subgroup intake *before* receiving a donation from STF
- Determine what percentage of participants met the USDA-FP for overall fruit, overall vegetable, and the five vegetable subgroups *before* receiving a donation from STF
- Estimate the potential⁶ average increase in the percent of the USDA-FP that could be met by participants for overall fruit, overall vegetable, and the five vegetable subgroups *after* receiving a donation from STF
- Estimate the percentage of participants who had the potential to meet the USDA-FP for overall fruit, overall vegetable, and the five vegetable subgroups *after* receiving a donation from STF
- Determine the relationship between the number of times a participant had received a donation from STF in the past and whether they met the USDA-FP for overall fruit, overall vegetable, and the five vegetable subgroups
- Determine the relationship between the number of SNP participants used and whether they met the USDA-FP for overall fruit, overall vegetable, and the five vegetable subgroups

Each participant's answers to the food frequency record were recorded and standardized as a one cup serving size for fruit and vegetable subgroups. Servings were standardized to one cup in

² these data were measured as a *potential* average increase because whether participants actually ate the produce they received and indicated their intent to eat could not be confirmed in this study

order to correlate with the measurements utilized in by the USDA-FP for fruit and vegetable servings. Participants' answers to the food frequency record portion of the survey were compared to the USDA-FP to determine if their average weekly fruit and vegetable intake met or fell below the USDA-FP *before* receiving a donation from STF according to their age and gender (USDA, 2017). When determining whether individual participants had met the USDA-FP, gender and age were taken into account while still maintaining privacy. Participants recorded the foods they received, how they intended to prepare them, and the number of children and adults to whom they would be served. This was accomplished via multiple choice questions with multiple answer options. The researchers used this data to determine how much of the produce received was intended to be consumed by the individual. Participants' responses were then analyzed and factored into their answers from the food frequency record. This data was used to determine if participant's potential to meet the USDA-FP increased *after* receiving a donation from Seeds that Feed and to what degree.

Data from the food frequency record was also compared with a) participant income, race, and region of residence in Fayetteville b) number of times a participant had received a donation from STF in the past and c) how many, if any, SNP were used by the participant to determine whether or not any correlation existed with overall fruit, overall vegetable, and vegetable subgroup intakes.

Results and Discussion

Demographics

Table 1. Relationship Between Racial Status and Participants Who Met the USDA-FP for Total Fruit, Total Vegetable, and Total Vegetable Subgroup Consumption Prior to Study

	<u>Fruit and Vegetable Groups</u>						
	Total vegetable	Total fruit	Leafy green vegetables	Other vegetables	Red/orange vegetables	Starchy vegetables	Beans and legumes
<i>Majority-status participants who do not meet the USDA-FP (%)</i>	75%	67%	8%	42%	92%	83%	33%
<i>Minority-status participants who do not meet the USDA-FP (%)</i>	27%	27%	9%	36%	63%	55%	27%

As of 2017, 13% of Washington County was of minority status (majority status in Washington County is Caucasian, non-Hispanic) according to the United States Census Bureau (United States Census Bureau, 2017). However, 48% of the sample population were of minority status. This increase in percentage was expected based on previous research that found minority status as an indicator of food insecurity, and this sample was comprised solely of participants in a food assistance program (Morland and Filomena, 2007; Freedman, 2009; Strome, et al. 2016; Schlundt, et al. 2017). Surprisingly however, more participants of majority status than minority status reported an inadequate intake of all produce groups except for the vegetable subgroup: leafy greens, although slight.

Table 2. Relationship Between Poverty Status and Participants Who Met the USDA-FP for Total Fruit, Total Vegetable, and Total Vegetable Subgroup Consumption Prior to Study

	<u>Fruit and Vegetable Groups</u>						
	Total vegetable	Total fruit	Leafy green vegetables	Other vegetables	Red/orange vegetables	Starchy vegetables	Beans and legumes

Participants who do not meet the USDA-FP <i>above</i> the poverty line (%)	60%	60%	10%	30%	80%	80%	50%
Participants who do not meet the USDA-FP <i>below</i> the poverty line (%)	46%	38%	7%	46%	77%	62%	15%

In a similar comparison we find that 57% of the sample population was below the poverty line while only 15.8% of Washington County as a whole is below the poverty line as indicated by the United States Census Bureau (United States Census Bureau, 2017). Again, this was expected since income is also a strong predictor of food insecurity and the sample was comprised solely of participants active in a food assistance program (Zepeda et al., 2014; Nunnery et al., 2018). Surprisingly however, more participants above the poverty line reported an inadequate intake of all produce groups. These conflicting data might be attributed to several factors. First, the sample may not be representative of the county as whole. Second, dealing with income, people have an inherent propensity to over report their actual income (Moore et al., 2000). The issue with inflating one's income is that this inflation is not consistent across people and as such can lead to bias income differences. Third, there might be varying levels of self-selection bias at work. By definition those below the poverty line and/or of minority status may be more likely to participate in Seeds that Feed and as such the study might have a disproportionally high percentage of participants below the poverty line and/or of minority status. As such, the results, while robust and absolute for this study, may lead to counterintuitive relative results for the area as a whole. Finally, these data suggest that either a) sample size was too small to gather sufficient data to represent all of Northwest Arkansas and/or b) race, income,

and geographical location were not predictive factors of food insecurity in Northwest Arkansas.

Further research is necessary to determine such conclusions.

Diet

Table 3. Percentage of Participants who Met the USDA-FP for Overall Fruit, Overall Vegetable, and Vegetable Subgroup Intake Before Receiving a Donation from Seeds that Feed

	<u>Fruit and Vegetable Groups</u>						
	Total vegetable	Total fruit	Leafy green vegetables	Other vegetables	Red/orange vegetables	Starchy vegetables	Beans and legumes
Participants (%)	49%	57%	91%	61%	22%	30%	70%

According to participants’ self-reported answers to the food frequency record, none of the USDA-FP of the fruit and vegetable groups represented in the study were met by all of the participants. These data fall in line with the 2015-2020 Dietary Guidelines which states that, “with few exceptions, the U.S. population does not meet intake recommendations for any of the vegetable subgroups” and as a whole, the U.S. population ranging from 9-71+ years old, does not meet the intake recommendations for fruit either (USDA, 2015). The represented fruit and vegetable groups included total fruits, total vegetables, and the vegetable subgroups: leafy greens, other, red/orange, starchy vegetables, beans and legumes. For example, leafy greens include vegetables such as: broccoli, spinach, kale, collard greens, turnip greens, and mustard greens. Other vegetables include: iceberg lettuce, green beans, onions, cucumbers, cabbage, celery, zucchini, mushrooms, and green peppers. Red/orange vegetables include: tomatoes, red peppers, carrots, sweet potatoes, winter squash, and pumpkin. Starchy vegetables include: white potatoes, corn, green peas, green lima beans, plantains, and cassava. Lastly, beans and legumes include: kidney beans, white beans, black beans, lentils, chickpeas, pinto beans, split peas, and edamame (green soybeans), but it does not include green beans or green peas (USDA, 2015). In other words, at least one—and in most cases more than one—participant fell short of the USDA-

FP for every fruit and vegetable groups represented in the study. Twenty-one of the 23 (91%) participants did *not* meet the USDA-FP for one or more of the fruit and vegetable groups represented in this study. In fact, on average, participants did not meet the USDA-FP for three of the seven fruit and vegetable groups, and at the low-income family housing location, the average was four out of seven fruit and vegetable groups unmet.

Participants received approximately one cup of fruit total and 1 ½ cups of vegetables total from STF. From these amounts only, the participants' potential to meet the USDA-FP for total fruit, total vegetable, leafy green vegetables, other vegetables, red/orange vegetables increased by 10%, 9%, 66%, 38%, 21%, respectively. SV and BL were not donated during this study, therefore, no data could be gathered regarding either vegetable subgroup. These data are reflected in Table 4. This means that after receiving approximately 1 ½ cups of fruit and/or approximately one cup of vegetables participants' potential to meet the USDA-FP increased on average by 10% for total fruit and 9% for total vegetables. Likewise, for each participant who received approximately one cup of vegetables from a particular vegetable subgroup, their potential to meet the USDA-FP increased on average by 66% for the leafy greens subgroup, 38%, for the other vegetables subgroup, and 21% for the red orange subgroup. This information was gathered by comparing individuals' responses to the food frequency record with each food item they received and the amount that they indicated they would eat themselves.

Table 4. Average Percent Increase in Participants' Potential to Meet the USDA-FP for Each Fruit and Vegetable Group

	Fruit and Vegetable Groups						
	Total vegetable	Total fruit	Leafy green vegetables	Other vegetables	Red/orange vegetables	Starchy vegetables	Beans and legumes
Average increase in potential to meet the USDA-FP (%)	10%	9%	66%	38%	21%	NA ^a	NA ^a

^a NA indicates that this vegetable group was not donated by STF during the study

Table 5. Percentage of Participants who Met the USDA-FP for Overall Fruit, Overall Vegetable, and Vegetable Subgroup Intake Before Receiving a Donation from STF Compared with the Percentage of Participants who had the Potential to Meet the USDA-FP After Receiving a Donation from STF

	Fruit and Vegetable Groups						
	Total vegetable	Total fruit	Leafy green vegetables	Other vegetables	Red/orange vegetables	Starchy vegetables	Beans and legumes
Before (%)	49%	57%	91%	61%	22%	30%	70%
After (%)	57%	61%	91%	74%	22%	-	-
Increase (%)	8%	4 %	No change	13%	No change	NA ^a	NA ^a

^a NA indicates that this vegetable group was not donated by STF during the study

Before receiving a donation from STF during the study period, the percentage of participants who met the USDA-FP for total vegetable, total fruit, leafy green vegetables, other vegetables, red orange vegetables, starchy vegetables, and beans and legumes were 48%, 57%, 91%, 61%, 22%, 30%, and 70% respectively, as indicated in Table 5. After receiving a donation, the percentage of participants who had the potential to meet the USDA-FP for total vegetables, total fruit, and other vegetables increased by 9%, 4%, and 13% respectively, as indicated in Table 5. Consequently, 57%, 61%, and 74% of participants had the potential to meet the USDA-FP for total vegetable, total fruit, and other vegetables respectively after receiving a donation from STF. There was no percent change for leafy green vegetables or red/orange vegetables. Starchy vegetables and beans and legumes were both considered Not Applicable (NA) because vegetables from these subgroups were not provided by STF during the study.

Supplemental Nutrition Program Impact

Table 6. Total Number of Times Participants Have Received a Donation from STF

Times participants have received a donation from STF	Number of participants
>24	2
6-8	3
1-4	4

Table 7. Relationship Between the Number of Times Participants Received a Donation from STF and if They Met the USDA-FP

Total number of times participants have received a donation from STF	Fruit and Vegetable Groups						
	Total vegetable	Total fruit	Leafy green vegetables	Other vegetables	Red/orange vegetables	Starchy vegetables	Beans and legumes
>24	50%	50%	100%	100%	50%	0%	0%
6-8	0%	33%	100%	67%	0%	67%	33%
1-4	50%	25%	100%	50%	25%	0%	50%

Nine participants (39% of total) received a donation(s) from STF prior to the study. Two participants had received over 24 donations, three participants had received a 6-8 donations, and four participants had received 1-4 donations. The categories of total fruit and other vegetables had a positive correlation with the number of times participants had received a donation from STF. Those who received more donations from STF were more likely to have met the USDA-FP for total fruit and other vegetables intake. For red/orange vegetables, only those who received over 24 donations from STF had a higher chance of meeting the USDA-FP. A negative correlation was observed for beans and legumes intake and number of times participants received a donation from STF, however this is most likely spurious correlation. No other correlation or significant relationship was observed for the other fruit and vegetable groups. Due to the small number of participants represented in this study, more research is required to determine the validity of this conclusion.

Table 8. Number of SNP Used by Participants

Number of SNP used	Number of participants
2+	4
1	12
0	7

Table 9. Relationship Between the Number of SNP Used by Participants and if They Met the USDA-FP

Number of SNP used	<u>Fruit and Vegetable Groups</u>						
	Total vegetable	Total fruit	Leafy green vegetables	Other vegetables	Red/orange vegetables	Starchy vegetables	Beans and legumes
2+	25%	50%	100%	50%	0%	0%	75%
1	67%	75%	92%	75%	42%	42%	67%
0	29%	29%	86%	43%	0%	29%	71%

Sixteen of the 23 participants reported that they used at least one SNP. Four participants reported that they used more than one SNP. The categories of leafy green vegetables and beans and legumes were the only groups that had a positive association with the number of SNP used. Use of one SNP or more increased participants' likelihood of meeting the USDA-FP for leafy green vegetables and beans and legumes vegetable subgroups. No other correlation or significant relationship was observed for the other fruit and vegetable groups observed. Due to the small number of participants represented in this study, further research is recommended to determine the validity of this conclusion.

Limitations

This study included some limitations. The study started in late Summer and ended in late Fall, resulting in different types of produce and quantities being available at the location sites. Likewise, some of the produce available at the first distribution site was not yet represented in the survey. Consequently, some of the produce collected by these participants went unrecorded. As such, some of the changes in consumption and percentage of daily intake of a targeted goal after receiving produce from STF might be underestimated.

Answers from the food frequency record and intended use portion of the survey were all recorded as one cup servings in order to standardize participants' responses. While this may be more or less than what participants actually consumed or planned to consume, the percent change would still be the same. Food frequency and intended use data were all based on the

participants' feedback. The accuracy of their responses depends completely on their honesty during the survey. It is possible that low levels of bias may have occurred regarding income and food frequency record. Often, participants answer in in such a way that they think will a) benefit themselves in some way or to b) give the answers that they believe the researcher(s) want to collect (Randall and Fernandes, 1991). Likewise, researchers could not assess whether or not participants consumed the actual amount that they intended to on the survey or if the produce spoiled prior to consumption. Therefore, increased availability was measured, not increased intake.

Finally, some participants did not include themselves when reporting household size. This was confirmed when the researcher observed that some of the responses for household size only included children and no adults. Therefore, the researchers had to assume that these participants were the head of a single household.

Conclusions

The purpose of this study was to determine if a SNP that focuses on distributing fresh produce via mobile pantry to families and individuals who face barriers with access to fresh fruits and vegetables *can* in fact increase these individual's access to fruits, vegetables and the vegetable subgroups and as a result, increase individual's potential to meet the USDA-FP. According to participants' self-reported food frequency record responses, 21 of the 23 (91.3%) participants did *not* meet the USDA-FP for one or more of the fruit and vegetable groups represented in this study. In fact, on average, participants did not meet the USDA-FP for three of the seven fruit and vegetable groups represented in the survey, and at the low-income family housing location, participants' diet did not meet four of the seven groups defined by the USDA-FP.

Access to fruits and vegetables provided by STF significantly increased participants' likelihood to meet the USDA-FP for all of the fruit and vegetable groups represented in this study excluding starchy vegetables and beans and legumes which were not donated in this study. No limit was set regarding how much each participant could receive, what participants selected for themselves and their household averaged out to approximately one cup of fruit and approximately 1 ½ cups of vegetables per participant. Using the results from the food frequency record and the intended use portions of the survey, researchers were able to determine that upon receiving approximately one cup of fruit and 1 ½ cups of vegetables from one donation day alone, participants' potential to meet the USDA-FP for total vegetable, total fruit, leafy green vegetables, other vegetables, and red/orange vegetables increased by 10%, 9%, 66%, 38%, 21% respectively. These results indicate that one to two 1-cup servings of fruits and vegetables alone has the power to significantly increase individuals' potential to meet the USDA-FP for these fruit and vegetable groups.

After receiving a donation from STF, the percentage of participants who had the potential to meet the USDA-FP increased for total vegetable, total fruit, and other vegetable subgroup by 8%, 4%, and 13% respectively. No change in percentage of participants who *met* the DGA for leafy green vegetables and red/orange vegetables was observed even though their *potential* to meet the USDA-FP increased. However, these data do support the theory that produce-based donations *can* help individuals increase their likelihood to meet the USDA-FP for total fruit and vegetable, and some vegetable subgroup intake.

Finally, researchers compared the participants' answers to the food frequency record to the number of times they had received a donation from STF ever in the past and to the SNP(s) they reported using. Participants who reported receiving a greater number of donations from STF

in the past were likely to have met a greater percentage of the USDA-FP for total fruit and the vegetable subgroup: other vegetables. Only participants who had received more than 24 donations from STF met a greater percent of the USDA-FP for the vegetable subgroup of red and orange vegetables.

Participants who reported using a greater number of SNP also were likely to have met a greater percentage of the USDA-FP for the vegetable subgroups, leafy green vegetables and beans and legumes. These data indicated that 1) the frequency of visits from STF and 2) the number of SNPs used may increase individuals' likelihood of meeting the USDA-FP for certain fruit and vegetable groups. Due to the small number of participants represented in this study, more research is required to determine the validity of this conclusion.

In conclusion, SNPs who prioritize distributing fresh produce to food insecure families and individuals via mobile pantry have the ability to increase individual's access to and potential intake of fruits and vegetables as indicated by this study. Further research is necessary to determine the actual increase in fruit and vegetable intake among food insecure communities from STF's services and similar SNPs.

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