

Undergraduate Honors Thesis

Food Support Networks and their Relationship to Food Insecurity in Colorado Counties

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Abstract

Food insecurity has reemerged as a significant social problem in the United States, despite the fact that we produce more than enough food as a nation to feed all of our citizens. Since the economic recession in 2007, food insecurity has increased, and in recent years has remained at 14.3%. Many strategies have been adopted to address food insecurity in the U.S., some of which are sponsored by the federal government, such as SNAP and the School Lunch Program, while others are donation-driven non-profit organizations, such as food pantries. While there are a number of food support networks that have been established with the intent of decreasing food insecurity, there are still gaps in the food system in which food is wasted and people are hungry. This study explores contemporary food insecurity within Colorado counties, specifically the effectiveness of existing food support networks, the drivers of food insecurity (aside from the factors that are used to calculate the county food insecurity rate), and how effective two local non-profit organizations, Boulder Food Rescue and Denver Food Rescue, have been at addressing hunger and food insecurity in the communities in which they operate. In this study I used both quantitative analyses of Colorado counties as well as qualitative interviews with key players addressing food insecurity. Results demonstrated that the number of food pantries in a county and the presence of a food rescue organization are both positively related to the county's food insecurity rate. As the literature suggests, this indicates that food pantries and food rescue organizations are more likely to locate in areas of high food insecurity. The most statistically significant drivers of food insecurity are the percentage of individuals with a high school diploma (the higher the percentage, the lower the rate of food insecurity) and the number of individuals where English is not their first language (the higher the percentage, the higher the rate of food insecurity). Lastly, both Boulder and Denver Food Rescue have filled an interesting gap in the food system, as both organizations are helping supplement a growing trend of providing fresh and nutritious fruits and vegetables to food-insecure individuals. Furthermore, both non-profits have succeeded at reaching several key traditionally unreachable food insecure populations, such as the elderly and people for whom English is a second language.

Introduction

In 2013, 14.3% of households in the United States were considered food insecure¹. This number is 2.7% higher than the 2005 – 2007 average, much of which can be explained by the spike in food insecurity that occurred due to the economic recession beginning in 2007. As food insecurity has risen in recent years, there is great importance in understanding its causes and means of its alleviation. Colorado has a statewide food insecurity rate of 13.9%, with a margin of error of +/- 1.29%, demonstrating that Colorado is a fitting case study for U.S. food insecurity given that it approximates the U.S. average (14.5%)¹.

The purpose of this study is to assess how existing food support networks in Colorado are related to food insecurity, what significant factors contribute to food insecurity, aside from those factors that were used to calculate food insecurity rates (e.g. economic status), and to fully understand how two food support organizations, Boulder and Denver Food Rescue, are acting to address food insecurity in their local communities. For the purposes of this paper, I define a food support network as any nonprofit, business or government entity whose primary objective is to contribute to the alleviation of food insecurity.

Literature Review

History of Food Insecurity/Drivers of Food Support

To understand the significance and importance of modern day food insecurity, it is first important to understand food insecurity within the context of United States (U.S.) history. Food insecurity was first widely recognized in U.S. society during the Great Depression. Throughout this period, a large portion of the U.S. workforce was unemployed. Simultaneously, farmers were struggling to pay off the expenses of industrial farming equipment, much of which had been

purchased in the wake of the technological advances developed during the Industrial Revolution. These factors contributed to all-time high food prices, despite high levels of production ². In response, the U.S. government provided the first government-sponsored food aid to alleviate the burden of food insecurity in the U.S.. In 1932, Congress implemented a program allowing the government to purchase excess wheat supplies and donate them to hunger relief charities, which simultaneously improved food security and kept farm production levels high due to sustained demand ³.

Throughout the remainder of the 1930s and 1940s, the federal government instituted additional food support networks, including Food Stamps (which recently underwent a name change and is now the Supplemental Nutritional Assistance Program, or SNAP) and the National School Lunch Program, which are still recognized as important support structures that help combat food insecurity and hunger to this day ⁴. Since the time of the Great Depression, the U.S. has not grappled with nationwide food insecurity of a similar caliber. The food support networks implemented during the Great Depression continue, however, to contribute to food security. By April 1965, the federal government's Food Stamp program was supporting half a million people, by May of 1970 it was supporting six million, and by October of 1974 it was supporting 15 million ⁵.

In the early 1980s, the U.S. experienced a recession in which the federal government was forced to cut funding to many of its social programs, making hunger, and as a consequence, food insecurity, once again an important federal issue ⁶. The recession caused unemployment rates to rise and many food insecure households began to depend on food banks and faith-based food pantries for many of their meals ⁷. It was during this time period that food banks grew in number, primarily in an effort to meet the growing need to support food insecure individuals. Today,

many of these food support networks still play a complementary role to SNAP and other government food support programs in curbing hunger in communities around the U.S., in particular in times when families and individuals are under economic stress. As of early 2014, the SNAP program was serving 46.5 million people nationally each month, and in 2012 the National School Lunch Program provided lunch to 31.6 million children across the nation on average each day ⁵.

Food Waste

It is estimated that 40% of food in the U.S. goes uneaten every year, amounting to the largest contributor to municipal waste ⁸. The issue of reducing food waste, which is a potentially important solution to curbing hunger, is not easily dismantled, as there are a wide variety of reasons that food is wasted. Starting at the source, much of the food that is grown in this country (and abroad but destined for U.S. markets) goes unharvested. Market prices often make it uneconomical for farmers to harvest their product ⁸. Even public perceptions of the quality of a specific type of food can have an enormous impact on how much food goes unharvested. For instance, in 2008, a salmonella scare in the tomato sector resulted in approximately 32% of all tomatoes going unharvested, which were ultimately left to rot in the fields because farmers feared the tomatoes would not sell at a profitable price ⁹. Overall, it is estimated that 7% of agricultural fields go unharvested annually, amounting to a significant portion of annual food waste in the U.S. ¹.

Culling is also responsible for a significant quantity of domestic produce loss. Culling is the process of removing specific fruits and vegetables based on their marketable appearance ⁸. Culling is often manifested in the form of produce that is too large, too small, oddly shaped, or

that does not meet additional criteria. A citrus fruit packer approximated that anywhere from 20 - 50% of produce that he packs is perfectly edible, yet is deemed unfit to sell due to market standards of produce homogeneity¹⁰. Even after the food is prepared for shipment, it can spend up to four days waiting to be tested for quality, severely shortening its shelf life and increasing its likelihood of ending up in a landfill instead of being consumed by hungry individuals⁸.

Once the food reaches the marketplace, a large volume is also thrown away. Many grocery retailers throw away food several days before its *sell by* date in an effort to maintain the image and illusion of freshness¹¹. One food sales expert claimed that by her estimates \$2,300 worth of food is thrown away from the average grocery store on any given day¹². Much of the food that is discarded is perishable, such as fruits, vegetables, dairy, and meat⁸. It is these same perishable foods, specifically fruits and vegetables, which are often inaccessible for individuals who are considered food insecure¹³.

Food Deserts and Healthy Food Access

Grocery chains have recently recognized that there is more money to be made by investing in suburban grocery stores, primarily due to their wealthier clientele. As a result, there has been a mass exodus of healthy food options, especially full service grocery stores, from low-income areas, many of which are urban¹⁴. This is disproportionately harmful to individuals who live in low-income urban areas, as residents in these neighborhoods are already likely to suffer from many other burdens that indirectly and directly influence their health, such as poor air quality, limited options for physical activity, and exposure to urban pollution¹⁵.

Since unemployment is disproportionately higher in food deserts and healthy food is more difficult to obtain, many of these individuals rely on various food support networks, such

as food pantries and SNAP, to provide their families and themselves with adequate food ¹⁵. Yet many food support networks are incapable of providing their users with fresh and nutritious food that promotes long-term health ¹⁶. Food pantries developed this way for several reasons -- the storage capacities of many food pantries were not originally designed to store fruits and vegetables, as donors were never encouraged to donate fruits and vegetables, and the importance of making healthy fruits and vegetables available for food insecure recipients has only recently become a priority ¹⁶.

Increased consumption of fruits and vegetables is highly correlated with long term reduced risk of stroke, cancer, and cardiovascular disease ¹⁷. Since food pantries have a difficult time providing their users with fruits and vegetables, this is harmful to the long-term health of recipients of such food support networks. Hence, while food pantries, SNAP and other food support networks provide recipients with much needed food that helps reduce food insecurity, they do not always provide recipients with nutritious food that is critical in helping them stay healthy. Even though residents may be able to buy healthy fruits and vegetables with SNAP, they may not have the ability or time to travel to grocery stores or farmers markets that sell such fruits and vegetables.

By design, food pantries are often located in high poverty areas that already have a high demand for their services and make it challenging for them to reduce food insecurity. However, emerging trends demonstrate that food banks are beginning to value the necessity of a healthy diet with balanced portions of fruits and veggies. A study in Brown County, Wisconsin, demonstrated that 90% of food pantries will accept fresh produce, however, 47% of produce accepted will be thrown away ¹⁸. Feeding America, a non-profit, also notes that it plans to triple its distribution of fresh produce over the next five years, setting a goal that 40% of their total

food offerings should be fresh produce¹⁹. As a result of this ideological shift, food pantries are looking for new ways to supply their recipients with fresh produce.

One example of increasing access to healthy fruits and vegetables for food insecure residents is the growing number of urban community gardens. Not only do community gardens provide residents with increased access to fresh produce, but they also do not require the space needed for large-scale grocery stores¹⁶. When food insecure individuals are given the opportunity to participate in community gardens, they can supplement their diets with healthy fruits and vegetables that are otherwise difficult to access. A study in Flint, Michigan, revealed that households with one member who participated in a community garden were twice as likely to eat the recommended daily number of fruits and vegetables as households with no gardener¹⁶. A separate study of Latino families revealed that households with one or more members who participated in a community garden had increased their consumption of daily fruits and vegetables, measured by eating fruits and vegetables “several times a day”, from 18.2% to 84.8%²⁰. Yet community gardens require initiative, money, and time that are not always readily available in communities with high rates of food insecurity.

As food security, specifically access to healthy and nutritious food, plays a critical role in childhood health and school performance, and long term health in adults²⁰, it is important to evaluate the effectiveness of our current food support networks, and whether or not they are meeting the needs of food insecure individuals in the U.S. The existing literature reveals that food support networks (e.g., farmers markets, food pantries, community gardens, and food rescue organizations) may all play an important role in reducing food insecurity, specifically by reducing food waste and increasing the availability of healthy fruits and vegetables.

Methods

I adopted a mixed methods approach to answering two research questions: (1) What variables, aside from those used to calculate food insecurity, are most highly correlated with high rates of food insecurity? (2) What niche within the food support network system, are Boulder and Denver Food Rescue filling to address food insecurity, and have they been successful at reducing overall food insecurity in Boulder and Denver?

The quantitative analysis, which addresses the first research question, used county level data from Colorado to assess how the presence or absence of various types of food support programs relate to county level estimates of food insecurity. The complementary qualitative analysis, which addresses the second research question, relied on in-depth interviews with administrators of local food rescue programs to better understand the perceived impact they have had at reducing food insecurity in Boulder and Denver. The methods involved in each of these research approaches are described next.

Food Support Networks

To evaluate the relationships between food support networks and food insecurity in Colorado, I compiled a data set containing variables for all 64 Colorado counties from 2010-2013. The dependent variable in my analysis was the estimated county level food insecurity rate obtained from Feeding America²¹. These estimates were calculated using regressions of state level food insecurity data on established factors linked to food insecurity including state level poverty, unemployment, race/ethnicity, and household income. The resulting equation was then used in combination with county level measures of the independent variables to get predicted

values of food insecurity for all counties in the United States ²². I used their estimates of food insecurity for all Colorado counties.

The independent variables that measured the extent of the food support networks included the number of farmers markets accepting SNAP, the total number of food rescue programs (e.g. Boulder Food Rescue), and the total number of food pantries. In addition, I wanted to control for features of the population that could affect food insecurity that were not included in the construction of the dependent variable that might confound the association between food support network measures and food insecurity. These additional features included the percentage of the county's population that is female, the percentage of the county's population that is elderly (age 65 or older), the average number of people per household, the percentage of the population that is foreign born, the percentage of the county's population where English is not their first language, the percentage of the county's population that lives in a rural area, the percentage of the county's population with a high school diploma and the percentage of the county's population that has a bachelors degree. Due to the inclusion of state level poverty, unemployment, race/ethnicity, and household income variables in the calculation of the county's food insecurity rate, these variables measured were intentionally excluded from my statistical analysis.

Predictions about the relationship between the geographic location of food support networks and county level food insecurity are ambiguous. To the extent that the goal of such organizations is to reduce hunger, I predict that as the number of food support networks in a given county increases, the percentage of food insecure individuals will decrease.

(Unfortunately, it will be difficult to identify associations with Boulder and Denver Food Rescue's impact on food insecurity, as both organizations are less than five years old and thus

they have not likely had sufficient time to enhance food security to the point where it would translate into meaningful quantitative effects.) Conversely, the development literature suggests that food support programs will choose to locate in those counties with the highest levels of food insecurity²³. With this prediction, there will be a positive, rather than a negative, relationship between the presence of food support programs and county level food insecurity.

I also offer several additional predictions about the association between socio-demographic variables and food insecurity based on the findings of past studies¹. Specifically, I hypothesize that counties with a high proportion of women, low levels of education, more persons per household, high percentage of individuals who are foreign born, a high percentage of people who do not speak English as a first language and a high proportion of elderly will have the highest rates of food insecurity. In general, these population characteristics are all indications of levels of economic vulnerability, which is associated with food insecurity, though percent female is regarded as a feature associated with less food insecurity.

These variables that I chose to examine are defined and descriptive information is provided in Table 1.

Table 1. Variables used in the quantitative analysis for Colorado counties

Variable	Data Source	Mean	Standard Deviation
2012 County Food Insecurity Rate (percent)	http://www.feedingamerica.org/hunger-in-america/our-research/map-the-meal-gap/	13.66%	1.74%
County Population	www.feedingamerica.org/hunger-in-america/our-research/map-the-meal-gap/2012/co_allcountiesmmg_2012.pdf	78,795	157,659.6

Number of Farmers Markets Accepting SNAP	coloradofarmers.org	0.63	0.85
Total number of food rescue programs (e.g. Denver Food Rescue)	Boulderfoodrescue.org	0.05	0.21
Total number of food pantries	www.foodpantries.org/st/colorado	3.25	6.91
Percentage of the population that is elderly	http://quickfacts.census.gov/qfd/states/08000.html	16.53%	5.01%
Percentage of the population that is female	http://quickfacts.census.gov/qfd/states/08000.html	48.09%	3.57%
Number of people per household	http://quickfacts.census.gov/qfd/states/08000.html	2.43	0.26
Percentage of residents with a high school diploma	http://quickfacts.census.gov/qfd/states/08000.html	89.07%	5.81%
Percentage of residents with a bachelors degree	http://quickfacts.census.gov/qfd/states/08000.html	29.11%	13.03%
Percentage of the population that is foreign born	http://quickfacts.census.gov/qfd/states/08000.html	6.61%	4.30%
Percentage of the population where English is not their first language	http://quickfacts.census.gov/qfd/states/08000.html	14.09%	9.29%

Percentage of the population that lives in a rural area	http://quickfacts.census.gov/qfd/states/08000.html	58.7%	36.6%
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After generating these descriptive statistics, I then estimate bivariate correlation coefficients for each independent variable in relation to county food insecurity rates. Finally, I estimate a set of multiple regression equations to evaluate whether or not there was a statistically significant relationship between the food support and socio-demographic independent variables and food insecurity. All statistical analysis was completed using R.

Boulder and Denver Food Rescue

Data regarding Boulder and Denver Food Rescue were derived from interviews with directors of both organizations, as well as the directors of recipient organizations. Interviews were conducted either in person, or by phone or Google Hangouts. Before conducting any interviews, my interview process was outlined and submitted to the Institutional Review Board (IRB), to ensure that all interview processes conformed with the IRB’s ethical standards of research. I contacted the directors of Boulder and Denver Food Rescue through email, which was obtained from the websites of each respective organization. Each director subsequently provided me with contact information of their most prominent recipient organizations in an effort to expand my scope of contacts and understanding of how Boulder and Denver Food Rescue interact with potentially complementary organizations.

Each interviewee was asked to sign a consent form (attached in Appendix A), detailing the purpose of my research and the minimal risks associated with an interview. Each interviewee

also consented to the recording of each interview, and granted me their consent to use their names and associated organizations when discussing interview results. Interview recordings were stored on secure electronic devices, either a computer or a smartphone, each of which are password protected. Interviews will be deleted after completion of the research and evaluation process. Two potential interviewees declined to be interviewed. Interviewees are identified in Table 2.

Table 2. Information about interview candidates

Name	Organization	Title
Hana Dansky	Boulder Food Rescue	Director
Turner Wyatt	Denver Food Rescue	Director
Barbara O’Neil	Harvest of Hope, Boulder	Director
Kayla Birdsong	Denver Growhaus	Director of Food Distribution
John Trejo	Boulder Bridgehouse	Head Chef

Notes were taken during each interview and compared to the recorded versions afterward to ensure that no important details were omitted from the notes. Interviews were subsequently analyzed, searching for key details that would provide important insight into Boulder and Denver Food Rescue’s operations. This information, grounded in first hand accounts, is the basis for my qualitative case study analysis of Boulder and Denver Food Rescue’s effectiveness at reducing food insecurity in Boulder and Denver, Colorado. Interview questions that were asked are included in Appendix B.

Regarding my qualitative analysis, I predict that Boulder and Denver Food Rescue have been successful in providing supplemental nutritious food to their recipient organizations. Furthermore, I predict that their recipient organizations would otherwise not have the capability

to obtain fresh produce on a regular basis, due to the lack of fresh produce available from other food support networks.

Statistical Analysis of Variables that are Hypothesized to Relate to Food Insecurity in Colorado

Correlation Coefficients

To calculate the nature of the association between each individual variable and food insecurity, I estimated correlation coefficients with each variable and the county food insecurity rate. The results from these correlation coefficients are detailed in Table 3 below.

Table 3. Correlations [r] between food insecurity and its associated drivers and food support networks

Variable	Correlation Coefficient	P value
Number of food pantries	0.27	0.03
Number of food rescue programs	0.26	0.04
Number of farmers markets	0.16	0.21
Percentage elderly	0.00	0.92
Percentage of population with a high school diploma	-0.44	<0.01
Percentage of population with a bachelors degree	-0.23	0.07
Percentage of population where English is not their first language	0.32	0.01
Percentage of the population who are foreign born	0.13	0.30
Number of people per household	-0.06	0.62
Percentage of the population who is female	-0.29	0.02
Percentage of the population that lives in a rural area	-0.27	0.03

Of the food support networks, which includes food pantries, number of farmers markets that accept SNAP, and number of food rescue programs (e.g. Boulder Food Rescue), the two variables with a statistically significant correlations with food insecurity at $p < .05$, were the number of food pantries per county ($p = 0.03$) and the presence of a food rescue program ($p = 0.04$). Farmers markets accepting SNAP did not achieve a statistically significant value ($p = 0.21$). Interestingly, the correlation between food pantries and food insecurity is positive, where high numbers of food pantries are linked to higher rates of food insecurity. This suggests that food pantries are indeed locating in areas with high food insecurity as the development literature would suggest²⁴. It also indicates that food pantries have yet to reduce food insecurity to levels equal to or lower than the levels of other Colorado counties.

I observe the same phenomenon with respect to the correlation of food insecurity and food rescue programs. Unfortunately, there are only three existing food rescues in the state of Colorado, all of which exist in densely populated areas. In addition, the recent addition of food rescue organizations makes it difficult to ascertain their effect as noted earlier. Taken together, this means that although the results achieve statistical significance, I am not confident that the association is real.

As for the number of farmers markets accepting SNAP, 32 out of 45 Colorado farmers markets (71%) participate. Despite such a significant portion of farmers markets accepting SNAP, it is evident that they have not had a statistically significant impact on food insecurity (neither a negative nor a positive correlation). This would suggest that farmers markets are still not widely available enough or are not fully utilized by food insecure individuals when they do exist.

With respect to the socio-demographic variables, the level of education in the county was an important demographic variable measuring economic vulnerability that had a strong statistically significant association with food insecurity. Although the relationship between food insecurity and education is not as strong when correlated with the percentage of the population with a bachelors degree compared to a high school diploma, my analysis found that the relationship between the percentage of the population with a high school diploma and prevalence of food insecurity was strong (correlation $r = -0.44$, $p = 0.0002$). I would argue that while county levels of education are strongly and negatively associated with levels of food insecurity, this association might actually be confounded by a number of other factors, such as race, income, and a variety of other variables that might explain both level of education and food insecurity. I address this later when I estimate multivariate regressions.

The association between county education and food insecurity changes when county education is measured by the percentage of the population with a bachelors degree. The correlation between proportion with a bachelors degree and food insecurity prevalence fails to achieve statistical significance though its association is suggestive (correlation $r = -0.23$, $p = .066$). This implies that although higher education is extremely important for climbing the socioeconomic ladder, it may not play an essential role in meeting one's basic needs of food security, at least not when measured at the county level. Furthermore, highly educated areas may enjoy the benefits of a more robust service industry, which may employ low-income individuals in well-paying jobs, such as food services, maintenance or landscaping. Such economic opportunities in a highly educated areas would likely have higher wages, providing otherwise food insecure individuals with a steady income, and hence distort the relationship between

bachelors degree and food insecurity. This interpretation is speculative and would need to be replicated and tested further.

English as a second language was positively and significantly associated with levels of food insecurity ($r = +0.32$, $p < .05$). Similar to county education levels, however, English as a second language is often a function of the proportion of the population that are immigrants, or first generation U.S. citizens, which was already built into the development of the food insecurity equation through minority status (e.g. Latino). Interestingly, English as a second language may also be indicative of food insecurity not simply due to the fact that immigrants and non-native English speakers face discrimination (e.g., searching for employment), but also are discouraged from or face barriers when attempting to utilize food support networks. English as a second language speakers may also seek food support from providers and vendors in ethnic enclaves, which were not explicitly accounted for in my study. When compared to the association between the proportion who are non-English speakers and food insecurity, the relationship between food insecurity and foreign status is weak and not statistically significant..

When food insecurity was correlated with other variables, such as the percentage elderly and persons per household, there was no statistically significant relationship. Regarding percentage elderly, I hypothesized that Colorado is a popular retirement area for many senior citizens who wish to take advantage of the state's natural beauty. Although there are many elderly who fall into low-income socioeconomic brackets, the relationship is likely offset by the wealthier elderly individuals who live in ski communities, or high-income retirement neighborhoods, such as those in Boulder.

The percentage of a county that is rural is significantly associated with county-level food insecurity, a result that is consistent with my literature review. Since counties with higher

proportions of rural residents are located further from full service grocery stores, they are more likely to have difficulties obtaining adequate food. Furthermore, as rurality increases, it becomes more difficult to find employment due to decreased demand for labor that comes coupled with declines in population density. However, it is noteworthy that completely rural counties (i.e., designated as being 100% rural) do not experience the highest rates of food insecurity because they are most commonly farming communities. These farming intensive communities often have adequate fresh food and they may engage in intra-farming trade which can help diversify the county's food supply at a household level.

The remaining variable with a statistically significant relationship with food insecurity is the percentage of the county's population that is female. As the proportion of the county population that is female increases, the food insecurity rate decreases ($r = -0.29$, $p < 0.05$). This correlation is one of the most powerful associations with food insecurity addressed in my analysis. This may be explained by emerging trends around the world regarding the intelligent economic decisions of women when made independently of a male partner. As marriage rates decline around the country and women gain more autonomy in existing marriages, the economic decisions that women make, especially when resources are limited, reflect a set of values that often prioritizes the basic needs of their family²⁵. Specifically, this may extend to how household finances are spent on food as my findings would suggest.

Multiple Regressions Linking Food Insecurity with Food Support Network and Key Sociodemographic Variables

The correlational analyses indicated that the percentage female, the percentage of the population with a high school diploma and percentage of the population that is rural were the

most important features affecting the prevalence of food insecurity, where each was considered in a series of bivariate analyses. To extend these analyses, I estimated three multiple regressions that adjust for these significant explanatory variables when determining the how each food support network variable was associated with food insecurity. The regression results are summarized in table 4:

Table 4. Multiple regression to better understand the impact of food support networks, controlling for percent female, percent rural and percent of the population with a high school diploma.

Model 1: food pantries

Variable	Regression Coefficient	T Value	P
Number of food pantries	0.001	2.587	0.012
Percentage of the population that is female	-0.001	-2.305	0.025
Percentage of the population that is rural	-0.005	-1.767	0.082
Percentage of the population with a high school diploma	-0.000	-3.689	0.000

Residual standard error: 0.014 on 59 degrees of freedom, Multiple R-squared: 0.3787, Adjusted R-squared: 0.337, N = 64

Model 2: food rescue programs

Variable	Regression Coefficient	T Value	P
Number of food rescue programs	0.009	2.190	0.032
Percentage of the population that is female	-0.001	-2.198	0.031
Percentage of the population that is rural	-0.005	-1.921	0.060
Percentage of the population with a high school diploma	-0.000	-3.526	0.001

Residual standard error: 0.014 on 59 degrees of freedom, multiple R-squared: 0.360, Adjusted R-squared: 0.317, N = 64

Model 3: farmers markets that accept SNAP

Variable	Regression Coefficient	T Value	P
Number of farmers markets accepting SNAP	0.003	1.485	0.143
Percentage of the population that is female	-0.001	-2.326	0.024
Percentage of the population that is rural	-0.006	-1.640	0.106
Percentage of the population with a high school diploma	-0.003	3.462	0.001

Residual standard error: 0.015 on 59 degrees of freedom, Multiple R-squared: 0.333, Adjusted R-squared: 0.288, N = 64

As demonstrated by these multiple regression models, when all of the most statistically significant explanatory variables are held constant, I find that that the number of food pantries is the most significant food support network variable that is associated with county-level food insecurity. Similar to the number of food pantries, we see that the number of food rescue programs is also associated with counties with high rates of food insecurity.

Food rescue programs exist in Boulder, Denver, and Colorado Springs, all of which are urban areas that allow for the food rescue model of biking food from grocery stores to food support programs. Therefore the capacity of the programs to relieve food insecurity is challenged by the mere population size of their service areas. In addition, this finding further supports the arguments that food support networks will choose to locate in areas with high food insecurity. However, the limited number of food rescue programs, occurring in only three counties, suggests that while its significance is noteworthy, it needs further replication (either when more counties in Colorado adopt such programs or in other states where they exist) in order to assess the validity of this association.

Consistent with the bivariate results, and after all other significant drivers are held constant, it is evident that farmers markets that accept SNAP do not have a statistically significant association with food insecurity. Interestingly, the number of farmers markets has a smaller (though still insignificant) p value than the bivariate association. This suggests that the included variables (female, rural, high school education) were likely associated with the farmers market measure and controlling for these three increased the significance of the farmers market variable. This turns out to be true especially for the fraction rural of a given county, as the correlation between the number of farmers market and percent rural is -0.50 ($p < 0.01$).

How have Boulder and Denver Food Rescue impacted the communities in which they operate?

My quantitative research suggests that food rescue programs may be playing an important role through their decisions to locate in counties with high levels of food insecurity. To explore this further, I turn next to the data and analysis of my qualitative interviews.

Background

In 2011, Boulder Food Rescue started its operation in Boulder, Colorado. The project began without much formal research, but instead was grounded in first-hand accounts of members of Food Not Bombs, a loosely based community of anti-hunger volunteers who would serve meals to the homeless on weekends²⁶. In their daily lives, the volunteers noticed that there was a tremendous amount of produce being wasted by grocery stores, and a desperate need for healthier food choices for Boulder's homeless population. The project came to fruition out of a simple idea, to bicycle produce that would otherwise end up in the trash, to hungry people instead who need it²⁶.

Feeding America, a national non-profit dedicated to hunger relief, receives significant amounts of preserved and canned foods each day. However, due to the bureaucratic policies and the sorting process of Feeding America, much of their food requires three to seven days from the time it is donated, processed in the warehouse and distributed to food pantries²⁶. As recognized by Food Not Bombs volunteers, there was a tremendous amount of produce that did not have the viability and longevity to survive this process, most commonly ending up in a landfill. By capitalizing on this unaddressed gap in the food system, Boulder Food Rescue hoped to further eradicate hunger in Boulder²⁶. In this context, it appears that Boulder Food Rescue came into being because the food needs were high in Boulder County.

After keeping receipts from donors, Boulder Food Rescue was able to gain official non-profit status, and secure regular weekly and daily donations from stores such as Ideal Market²⁶. As Boulder Food Rescue continued to grow and its reputation spread throughout Boulder, the founders began to contemplate the need to expand their operation beyond Boulder's homeless population. The volunteers and staff members determined that although Boulder's homeless

population was struggling with food security and access to nutritious food, there were likely many other individuals in need of food in Boulder County. Boulder Food Rescue decided to reach out to other organizations such as the Family Learning Center (Latinos), the Boulder Bridgehouse (homeless) and Harvest of Hope (homeless and low income single individual households) in an effort to expand its recipient demographic ²⁶. This expanded the scope of Boulder Food Rescue's operation, as their community partners grew and diversified, Boulder Food Rescue began to serve immigrants, members of faith-based communities, the elderly and low income households, many of which are headed by single parents.

In the past, individuals have questioned the legitimacy of Boulder Food Rescue's operation, in particular over fears of getting sick from donated food that did not sell in grocery stores. Fortunately, Boulder and Denver Food Rescue are protected by the 1996 Bill Emerson Good Samaritan Act, which states that:

individual or company 'shall not be subject to civil or criminal liability arising from the nature, age, packaging, or condition of apparently wholesome food or an apparently fit grocery product donate[d] in good faith to a nonprofit organization for ultimate distribution to needy individuals' except in cases of 'gross negligence or intentional misconduct.' ²⁷

Today, Boulder Food Rescue prides itself in having saved over 800,000 pounds of food, which has been redistributed to hungry individuals ²⁶.

Denver Food Rescue began as a side project of Boulder Food Rescue. Many of the coordinators and volunteers from Boulder saw the potential for a similar model of food redistribution in Denver with an untapped plethora of volunteers. Boulder Food Rescue organizers would regularly travel to Denver to facilitate group meetings and arrange food pick up

schedules²⁸. However, with no one to run and organize Denver Food Rescue, the program began to decay. In early 2014, a Boulder Food Rescue volunteer and former staff member, Kyle Huelsman, moved to Denver and was able to establish a well organized network of volunteers to help boost the legitimacy and reputation of this young non-profit²⁸.

Denver Food rescue encountered a number of significant obstacles during its genesis, as many of its volunteers and affiliates felt that there was not the need for Denver Food Rescue to exist with all of the other hunger relief and food redistribution organizations in Denver. Denver Food Rescue director, Turner Wyatt, pushed back against these assumptions and encouraged the group to remain open to the idea of adapting the general framework of Boulder Food Rescue in Denver, and figure out ways to transform the model so as to meet the unique needs of the Denver community. After a request for feedback and research, Denver Food Rescue learned that it had to adapt its model of redistribution to fit the needs of the communities in which it operates. Denver Food Rescue learned that there were many low-income neighborhoods, often comprised of immigrants and other non-native English speakers, who did not have a food pantry or network for hunger relief in their community. Soon Denver Food Rescue learned that the majority of the food pantries in Denver all seemed to be located in adjacent areas to each other, leaving huge gaps in the geographic proximity of food support organizations²⁸. Furthermore, many of these neighborhoods are also food deserts, that is areas that lack a full service grocery store with nutritious foods²⁸. See appendix C for a map of Denver's food deserts.

Unlike Boulder Food Rescue, Denver Food Rescue learned that by recruiting volunteers who live in the very neighborhoods that lack food support organizations, they could help implement grocery redistribution programs that were run and organized by the people who needed the food. By asking well-connected and credible residents of low income areas, Denver

Food Rescue could drop off large quantities of food from its donors to a home, where volunteers would sort the food, which could be picked up by members of the community who are in need of healthy produce and vegetables that would otherwise be difficult to access without a nearby grocery store or food pantry²⁸. In some cases the food was dropped off at a community center, such as a Boys and Girls Club. In other cases, Denver Food Rescue has worked with well established community support organizations, such as the Denver GrowHaus, which uses its indoor aquaponic system to grow greens for the surrounding community. The GrowHaus now offers cooking classes for its recipients, taught by local members of the community, so that recipients can maximize all the food that they receive. It is not uncommon to find that some recipients are unsure of how to cook certain food items. To date, Denver Food Rescue prides itself in redistributing more food every six weeks than it did in all of 2012.

Impact and Influence of Boulder Food Rescue in Boulder, Colorado

Boulder Food Rescue grew out of the first-hand experiences and activism of Boulder residents who noticed that large amounts of fruits and vegetables were going to waste in grocery store dumpsters every day while significant numbers of its residents went hungry. In an effort to help fill in this missing gap in the food system, Boulder Food Rescue started to redistribute produce, which would otherwise be discarded, to food pantries and other community organizations that serve food insecure communities. Many of these organizations lacked access to healthy fruits and vegetables²⁶. This demonstrates how Boulder Food Rescue is an example of a specific way in which food pantries can partner with food rescue organizations to help transition into institutions that provide healthy options to their recipients. The homeless population in particular has historically relied on soup kitchens and other support networks to

provide them with meals²⁹. Boulder Food Rescue provided many of these organizations with the necessary fruits and vegetables to improve the diets of their recipients.

Harvest of Hope is one example of a food pantry that operates out of Boulder County to serve low income and homeless individuals. On average, Harvest of Hope serves 50 - 80 individuals each day, with a total client database of 900, and has an organizational policy which states that they turn no one away³⁰. The objective of Harvest of Hope is simple: to feed people who are hungry and struggle to feed themselves on a regular basis, often due to economic hardship. Homeless individuals often fit this profile, yet Harvest of Hope also serves many students in Boulder who are having difficulty paying rent, tuition, and buying food. According to the Director of Harvest of Hope, they are always in need of more produce. O'Neil reports that fresh fruits and vegetables are in high demand at Harvest of Hope, and that many of their clients especially value organic fruits and vegetables. Since the primary recipients of the food at Harvest of Hope are homeless, many of them struggle economically, mentally, and face other forms of adversity. These daily challenges adversely impact their health. Therefore, it is critical that they have the opportunity to eat nutritious food in an effort to maintain their health. In total, Boulder Food Rescue provides Harvest of Hope with 7% of the food they distribute, totaling 71,000 pounds in 2013³⁰. Fruits and vegetables do not weigh a great deal compared to other forms of food that Harvest of Hope receives, such as canned goods, but they act as important nutritional supplements to the diets of individuals who cannot afford to buy expensive produce. Therefore, Boulder Food Rescue's donations play a critical role in the ability of Harvest of Hope to offer healthy choices to their recipients.

According to O’Neil, the Director of Harvest of Hope, if produce from grocery stores were to be donated to a larger food redistribution company, the food would likely spoil and never reach Harvest of Hope:

BFR brings it [food] straight to us within 15 minutes. Boulder Food Rescue really takes care of the fruits and vegetables... The clients know we get deliveries from Boulder Food Rescue every day... They [the recipients] always want to be the first ones in the door each day when we open to get the best stuff [produce from BFR] (O’Neil)

Donations of produce include varieties of lettuce, kale and other greens. Although sometimes recipients do not know what to do with the food, there is almost always a recipient or volunteer who does, and informally explains it to the staff so that they can relay the information to clients. O’Neil does state that Boulder Food Rescue could provide Harvest of Hope with more meat, dairy and eggs, but acknowledges that this is outside the scope of their ability due to the fact that Boulder Food Rescue provides the food that it receives from donations.

As the food that Boulder Food Rescue provides to Harvest of Hope has expanded, the benefits reaped by their recipients are evident. Harvest of Hope has a diverse clientele, including many elderly, Eastern Europeans and Latinos, many of whom use the food they receive from Harvest of Hope and Boulder Food Rescue to cook healthy and nutritious meals that they share with Harvest of Hope. However, Boulder Food Rescue is not only providing fruits and vegetables to Harvest of Hope, but also provides many pre-packaged sandwiches and wraps that would otherwise end up in the trash, helping grocery stores further reduce their environmental impact³⁰. Boulder Food Rescue’s synergies with Harvest of Hope demonstrates part of their aim to expand their recipient diversity to include food insecure communities that are not easily reached by donating to soup kitchens and other forms of instant food insecurity relief.

The Boulder Bridgehouse is another important beneficiary of Boulder Food Rescue's efforts. Unlike Harvest of Hope, the Boulder Bridgehouse uses food from Boulder Food Rescue directly in the meals that they prepare for their recipients. The executive chef at Boulder Bridgehouse, John Trejo, says that Boulder Food Rescue provides his organization with supplemental vegetables that allow them to improve the nutritional quality of the meals that they serve. Trejo says that produce such as cabbage, squash, potatoes, and kale play an instrumental role in increasing the vitamin content of their food, especially during winter months when donations from local farms are greatly reduced²⁹. The newly equipped Bridgehouse now boasts industrial strength freezers and refrigerators that can help the food kitchen save a significant portion of the produce they receive from Boulder Food Rescue for subsequent meals²⁹. Although the Bridgehouse's recipients are primarily homeless, Trejo states that their primary source of diversity is in the age of their recipients, ranging from 17 – 60 years old²⁹. Through the Boulder Bridgehouse, Boulder Food Rescue has clearly succeeded at expanding its scope to further encompass the elderly. When asked about Boulder Food Rescue's longevity, Trejo predicted that the program would expand as more grocery stores recognize that by donating fresh food that would otherwise be thrown away, they can help feed individuals directly affected by hunger.

Impact and Influence of Denver Food Rescue in Denver, Colorado

Denver Food Rescue's model has developed and evolved so that it is different from Boulder Food Rescue in several key ways. The most important of which is that the majority of their food is delivered to community organizers, rather than community organizations, who in

turn distribute the food to community members. As such, it was difficult to secure an interview with an official from an established organization. The Denver Growhaus (grow house), is one of Denver Food Rescue's most prominent recipients, and operates out of the Denver's Five Points neighborhood, one of the poorest in the city (also considered a food desert by the Growhaus)³¹.

When approached by Denver Food Rescue, Denver Growhaus was hesitant to implement a free grocery program for fear that it would devalue the food that it would give away³¹. At a community meeting the Growhaus learned that many individuals in the community were still going to bed hungry, hence there was a demand for extra food that could be provided, especially healthy food. Since the implementation of the program, the Growhaus gives away free groceries to approximately 55 families a week, most of them Latino³¹. Although providing recipients with much needed food, Birdsong claims that the most beneficial part of the free grocery program, made possible by Denver Food Rescue, is that the program is now almost entirely run by community volunteers. Individuals from the community teach cooking classes to show residents how to cook with foods that they may not be as familiar with (e.g. non-culturally appropriate foods)³¹.

Birdsong says that the main difficulty that they face with Denver Food Rescue is consistency in the food they receive, since much of the food provided by Denver Food Rescue is seasonal. Furthermore, the Growhaus would like to see more food from Denver Food Rescue, but recognizes that the non-profit is serving a wide array of individuals across Denver, and is supplying them with as much food as it can. Despite these criticisms, the free grocery program coupled with the cooking classes have been widely praised at increasing nutritional awareness in the community, increasing community cohesiveness, and most importantly providing residents

with better and healthier food³¹. Birdsong claims that Denver Food Rescue's efforts have helped the Growhaus flourish into "a food oasis in the middle of a food desert"³¹.

Although the Growhaus is a unique example of one of Denver Food Rescue's recipients, the real success of Denver Food Rescue comes in its ability to penetrate communities that are not able to take advantage of existing food support networks, something which is difficult to measure in my quantitative assessment. Turner Wyatt, director of Denver Food Rescue, claims that the majority of Denver Food Rescue's recipients, specifically those who help distribute the food in the community, are simply prominent community members with strong community ties and connections. Wyatt says that many of the food insecure individuals do not have the capacity to leave their homes due to disability, are fearful of deportation due to their immigration status, do not speak English, or are unaware of existing food support networks. Hence, by circumventing the bureaucracies of existing non-profits, many of which may have significant barriers of participation, Denver Food Rescue has succeeded at reaching those individuals who are in the deepest need of food support²⁸. Accordingly, Denver Food Rescue can drop off food at the homes of prominent community members, who are then entrusted, with the aid of other volunteers, to distribute the food equally amongst community members who are in need of fresh produce²⁸. With the only major threat to the longevity of Denver Food Rescue being sustainable funding, the adaptable model of Denver Food Rescue demonstrates how the scope of their operation may be small, but is successful in reaching individuals who otherwise are inadvertently incapable of subscribing to other food support networks.

Conclusion

Food insecurity in Colorado is still problematic, persistent and prevalent. Many food support networks have been implemented to help address food insecurity, but as demonstrated in my research, the food support networks do not coincide with decreased food insecurity. Rather, it is evident that the number of farmers markets accepting SNAP in a county has no statistically significant correlation with the food insecurity rate. Other factors, when incorporated in a multiple regression, which included the most significant drivers for food insecurity, do not help alleviate food insecurity, but rather are positively correlated with it. This shows that food support networks are most common in areas where there is the greatest need for food support. This is a common theme throughout much of development literature as well, as many forms of international development and aid are implemented in geographic regions with high rates of poverty and disease, and demonstrate an ongoing effort to amend the problem, but have yet to eradicate it.

My case study investigations of Denver and Boulder Food Rescue provided additional insights about the workings of one type of non-governmental food support program. Interviews with directors of Boulder and Denver Food Rescue, and their recipient organizations, showed that both of these non-profits have found an interesting niche in the food support network system. As predicted, the direct redistribution model used by both organizations drastically enhances the ability of other food support programs to provide their residents with healthier fruits and vegetables, which are much needed in these communities. This also is part of a growing trend in the food support network system, especially among food pantries. More importantly is the initiative and continued efforts of Boulder and Denver Food Rescue to search for ways to distribute their food to individuals who do not have access to food pantries, such as

English as a second language speakers, the disabled, and the elderly. Unfortunately, the model used by Denver and Boulder Food Rescue rely on high population density, high density of grocery stores, and urban areas with sufficient means for bike transportation. Thus, it would be difficult to replicate food rescue programs in rural areas impacted by food insecurity.

Alternatively, one might postulate that a car-based food rescue could succeed in rural regions of Colorado should there be adequate food waste available from grocery stores and existing food support networks to help redistribute the food.

After compiling all of the research, I conclude that the model used by Denver and Boulder Food Rescue should be exported to other densely populated urban centers. If food rescue programs are to locate in areas where the need is the greatest, then my regression analyses suggest that expansion should be targeted to other urban areas, where education levels are relatively low (i.e., high percentages of residents have not graduated from high school), and where the percentage of the population that is male is relatively high. My qualitative interviews suggest that the mechanisms used by Denver Food Rescue especially would likely be successful in urban areas where there is a high percentage of individuals who speak English as a second language and who would be less likely to utilize existing food support networks and would be more accessible when food is distributed through prominent and trusted community members. As discussed by directors of both Denver and Boulder Food Rescue, and their recipient organizations, there are still many hungry individuals in need of produce and food, which is being wasted at grocery stores. The question then becomes how can we reach these individuals. Denver and Boulder Food Rescue's direct redistribution model is a mechanism for alleviating the inability to access fresh fruits and vegetables that needs to be expanded to cities across the country and around the world and promises to play a necessary step in reducing food insecurity.

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Appendix A. Consent Form

Dear Potential Participant [Actual Name]:

I am seeking your participation in a research study on the impact that Food Rescue Alliance has had at creating effective community change in regards to food insecurity. I am conducting this study as part of my undergraduate honors thesis at the University of Colorado, Boulder, within the arts and sciences geography department. I am contacting you because of your employment at one of Food Rescue Alliance's participating locations, your involvement in a recipient organization, or because of your role in advocating or writing the legislation that made Food Rescue Alliance possible.

Before you decide whether to participate in this study, it is important for you to understand why the research is being done and what is involved. The study is interested in evaluating the qualitative impacts that Food Rescue Alliance has had in each community's rates of food insecurity.

STUDY PROCEDURE

Participation in this study involves taking part in an interview lasting 30-120 minutes at a time and place convenient to you. You will receive a copy of the interview questions in advance so that you can gather your thoughts. We will not necessarily discuss every question in detail or in this order, and you can choose not to answer particular questions. Unless you request otherwise, the interview will be audio recorded. At the beginning of the interview, you will be asked to indicate (1) your consent to participate (see below), and (2) whether you can be identified by name and organization in any publications that result from the project.

RISKS

The risks of this study are minimal. The only potential risk would arise if a comment that you requested not be attributed to you were somehow attributed to you despite efforts to disguise your identity.

BENEFITS

There are no direct benefits for taking part in this study. It is likely, however, that this study will increase public appreciation for Food Rescue Alliance, and potentially provide Food Rescue Alliance with further information to improve its programs.

CONFIDENTIALITY

At the beginning of the interview, you will be given the opportunity to indicate whether your name and organization can be associated with interview responses in any publications resulting

from this research. If you choose anonymity, you will not be identifiable from your comments. Regardless of whether you request anonymity, all interview recordings and transcriptions will be kept in a secure location (a password-protected computer or password protected mobile device). Transcription of the interviews will be done by the interviewer. Thereafter, only the researcher and the researcher's thesis advisor will have access to these records.

Person to Contact

If you have questions, concerns, or complaints about this study, or if you feel you have been harmed by this research, please contact Nathan Zick-Smith at 801-859-5039/nathanzicksmith@gmail.com or Dr. Elisabeth Root at 303-735-0264/Elisabeth.Root@colorado.edu.

Institutional Review Board: Contact the Institutional Review Board (IRB) if you have questions regarding your rights as a research participant. Also, contact the IRB if you have questions, complaints or concerns which you do not feel you can discuss with the investigator. The University of Colorado IRB may be reached by phone at irbadmin@colorado.edu/303-735-3702.

VOLUNTARY PARTICIPATION

Participation is voluntary. Refusal to participate or a decision to withdraw from the research will involve no penalty or loss of benefits to which you are otherwise entitled. Nor will refusal to participate affect your relationship with the investigator.

COSTS AND COMPENSATION TO PARTICIPANTS

There are no costs involved in participating in this research, and you will not be financially compensated for participation in this research.

CONSENT

Your consent to participate in this study will be documented via audio recording at the beginning of the interview.

If you choose to participate, please state your name, the date, and the following:

“I confirm I have read the information in this consent form and have had the opportunity to ask questions. I voluntarily agree to take part in this study.”

“I understand that my comments [are/[are not] being recorded.”

“I hereby [grant/withhold] my permission to use my name and that of my organization in any publications that results from this research.”

Thank you for your willingness to participate in this study.

Participant Name: _____ Participant Signature: _____

Date: _____

Researcher Name: _____ Researcher Signature: _____

Date: _____

Appendix B. Interview Questions

1. Why and how was the food support program started?
2. How was the county's food insecurity rate a motivating factor? If not, what was the motivating factor? What other research did you use to determine whether or not to implement your food rescue program?
3. What is your service area, and what is the population area your serving coming from, who are they, and what do they look like?
4. What are the goals of your program?
5. How important was it to have other food support programs in place in order to get the program started? What was the role in having other food support programs in place to get your program started?
6. What is the sort of food you are providing to recipient organizations? Do you feel that there are important categories of food that you are missing? Such as nutritious food? How often to you have to handle perishable food? Is it a regular problem?
7. What were the reasons why a specific geographic location (e.g. Boulder) was chosen for such a program?

8. What was the reasoning behind the implementation of such programs as a means of addressing food insecurity?
9. How do food rescue programs come to identify specific food insecure individuals or programs with which to partner?
10. Does the food rescue administrator see synergies between her/his program and other food support organizations? If so, what are they? With who and how do they support you, what are those synergies?
11. Was there any political, public health or social opposition to the food support program?
12. How important was the Colorado legislation protecting the program from liability in getting the program started? What role did this play in sustaining the program? Do you believe it is really important? Is there any other state or national legislation that is imperative to this process?
13. What is the extent to which you perceive food rescue programs as being effective at providing nutritious food? Such as fruits and vegetables?
14. What is the longer-term viability of the programs and possible threats to their endurance?
15. Do you feel that Food Rescue Alliance is meeting the needs of all your members, regardless of Race, Ethnicity, etc.?
16. Do you serve large immigrant populations? Do you feel you are able to provide culturally appropriate food, and if not what are the shortcomings there?
17. What other community organizations help support you in your work? What are their ties within the community?

18. Do you feel your organization is fully supported by Food Rescue Alliance (DFR or BFR depending on your location) in its ability to engage with your community and do the work you do?

Appendix C

