A Modified Rapid Assessment Method for Assessing Community Food Security

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INTRODUCTION

The ability to have consistent, dependable access to enough food for an active, healthy life is the basic definition of being food secure. While most people in the United States are food secure, each year there are millions of households that experience limited access to food due to a lack of money or other resources, and thus are considered food insecure. In 2011, there were an estimated 14.9 percent of households in the U.S. that were food insecure at least some point during the year (Coleman-Jensen, Nord, Andrews, and Carlson 2012). While public policies, such as SNAP, school meal programs, and other anti-hunger approaches exist to respond to food insecurity, these are largely reactive responses to the existence of hunger for a particular household.

Moving beyond the individual household, and the reaction to hunger, is the concept of community food security (CFS). This proactive prevention based concept looks to partnerships and community-based strategies that focus on nutrition, education, health, sustainability, and anti-hunger. An examination of community resources and responses that relate to food security has gained in popularity in recent years with goals of improving access to nutritious and affordable food, increasing self-reliance, and promoting local responses to food and nutrition issues (Lopez, Drake, Martin, and Tchumtchoua 2008; Bletzacker, Holben, and Holcomb 2009; Gundersen, Brown, America, Engelhard, and Waxman 2011; Kaiser 2012).

To perform a local assessment of community food security, the USDA Economic Research Service (ERS) developed the Community Food Security Assessment Toolkit (Cohen, Andrews, and Kantor 2002) which offers a standardized measurement for assessing the various aspects of the issue. While this is useful at a very local neighborhood level, and can identify specific needs to be addressed, it often requires significant investment in primary data collection and does not allow for a more streamlined initial assessment of larger geographic areas. The development of a rapid assessment method using available secondary data allows for measurement of community food security at town, county, and regional levels to help policy makers identify areas of concern to allocate resources for further in-depth analysis. This first look at the food environment is essential for identification of areas in need and development of effective policy.

Lopez, et. al. (2008) develop the rapid assessment method of CFS in a case study of Connecticut towns. Using secondary data and 38 indicators of CFS they applied a principal component analysis to rank the 169 Connecticut towns by their overall level of CFS. While this assessment method was well received in the local community and later utilized by other researchers (for example, Bletzacker, et. al. 2009 and Kaiser 2012) there was some concern expressed by local stakeholders about its practical use in developing strategies to improve a towns CFS. Given these concerns we focus in this paper on modifying the rapid assessment method to provide more straightforward and actionable pieces of CFS. To accomplish this we address three main goals: 1) to provide a ranking of towns based on income and socioeconomic characteristics that contribute to the risk for food insecurity; 2) to provide a ranking of towns based on geographic proximity to food retail options and the number of food retail establishments using location data, GIS technology, and roadways; and 3) to provide a ranking of towns based on the rate of participation in various public food assistance programs and the availability of public bus transportation.

Once again, Connecticut provides an excellent case study for this research but the methodologies are applicable throughout the United States and other areas with similar data availability. Not only is CT the focus of the initial rapid assessment method, but there is a wide disparity in income and other indicators of CFS. Given the level of governance in CT at the state and town level, a study of CT also provides the opportunity to look at a smaller geographic and policy relevant areas. This paper proceeds with a discussion of the literature followed by a presentation of the modified methodologies. We then present the results and discuss their impact throughout the state. Finally a discussion of future research concludes the paper.

RELEVANT LITERATURE

In what is considered the seminal piece in CFS research, Winne, Joseph, and Fisher (1997), outline a concept, design, and implementation guide for measuring community food security. This comprehensive guide goes through defining the concepts of CFS, understanding the need for a community-based assessment as well as planning process, and presents ideas for collaborations and coalitions to create change in local communities. Key to what has become an accepted definition of CFS is the idea that “all persons in a community have access to culturally

acceptable, nutritionally adequate food through local non-emergency sources at all times." The ideas they present of a systems approach that encompasses social, economic, and environmental bases of food systems is what has led to further research in this area.

Haering and Syed (2009) have put together a comprehensive survey of the literature related to various aspects of CFS in the U.S. They present a history of food security as well as reviewing literature pertaining to consequences, poverty, obesity, human rights, health care, and agriculture; all as they relate to food security. Much of their discussion, however, focuses on the individual and household measures of food security. The authors fail to capture the literature related to aggregate measures of CFS.

One of the first studies that focused on computing an aggregate measure of CFS was developed by Lopez, et. al. (2008). This study identifies 38 variables that are then broken down using factor analysis into 11 different categories for measuring CFS. Ultimately the authors compute a series of rankings and a combined overall ranking of CFS to provide a rapid assessment methodology of Connecticut towns. The goal of their research is to create a method to consider the multidimensional aspects of CFS in a way that accounts for the interrelations among factors that influence CFS. Following this approach, Bletzacker et. al (2009) study CFS in the Appalachian Ohio region. Our research uses Lopez et. al. (2008) and Bletzacker et. al. (2009) as a foundation for estimating a rapid assessment methodology but adds to the literature by modifying this methodology to provide a more stakeholder friendly approach for policy direction.

Another body of research measuring CFS has also begun to surface. Gundersen, et. al. (2011) has developed the Map the Meal Gap project that attempts to understand more about food security and the need at local levels. Using the USDA's food insecurity measures as well as income, unemployment rates, and measures of race (Hispanic and African-American), the authors are able to estimate a model to determine state level food insecurity rates. From these estimates the authors then predict a county level food insecurity rate based on the same variables in the state model. This is done for every county in the U.S.

In what is a hybrid of the two methods previously discussed, Kaiser (2012) first uses the Lopez, et. al. (2008) method to reduce 46 variables to 22 variables that results in 6 groupings of

CFS indicators. She also uses a regression approach similar to Gundersen, et. al. (2011) to estimate county level food uncertainty rates from state data. With these two measures, Kaiser uses a regression model to test whether the groupings from the PCA can explain the percentage of households that are food insecure in 114 counties and one city in Missouri.

While Gundersen, et. al. (2011) and Kaiser (2012) have added important elements to the body of CFS literature, our focus here is on the computation of a ranking method that can be applied at a more refined geographic level. The data that is used by Gundersen and Kaiser to predict county level food insecurity rates are not available at the town level. In some areas, such as Connecticut, it is more practical to consider a town assessment of CFS rather than a county.

METHODOLOGY

Community Food Security Indicators

Unlike other studies that focus on county level analysis, this study defines a community according to the geographic boundaries of the 169 towns in the State of Connecticut. We also narrow the focus to the development of three rankings in an effort to better inform and guide policy leaders and stakeholders that are interested in addressing food security in their community. In determining the groupings of variables, previous studies rely on empirical estimation to determine the appropriate category, however, this often yields categories of variables that do not fully align with stakeholder interests and are thus more difficult to apply in real world scenarios. In an effort to improve on this method we use a theoretical basis for determining the groups and then use statistical measures to develop the individual variable weights and subsequent rankings. We also use Geographic Information Systems (GIS) and roadway networks to calculate distances from census block group population centroids to different food retail options giving consideration to shopping opportunities beyond individual town borders. The GIS analysis is discussed more fully later in this section, whereas the statistical methodologies are discussed in the Data Analysis section.

A total of 37 variables are used in these indicators as outlined in Table 1. Data are obtained from the American Community Survey 5-year estimates, AC Nielsen Trade Dimensions

supermarket location database, and various local sources, more fully described in Table 1. The three ranking indicators are:

1. *Population At-Risk Ranking* - In this analysis we rank towns based on an examination of each town's particular population mix of income and socioeconomic characteristics to determine the likelihood that a resident in a particular town is food insecure.

The focus of this ranking is to include variables that are known to affect household food security. To this end we have included variables that measure income and poverty rates as well as the local unemployment rate. Household structure is measured using variables that represent the householders age, gender status as female, and the presence of large households and those with children. We have also included variables that represent high and low levels of education as well as the lack of private vehicle ownership that can increase food insecurity.

2. *Food Retail Ranking*- In this analysis we rank towns based on an examination of the geographic proximity from town population centers to food retailers and the number of food retail options for consumers. Recognizing a resident's ability to shop for food in neighboring towns, we have ignored political town boundaries for conventional food-at-home retailers such as supermarkets, grocery, wholesale clubs, and mass merchandisers in determining the food options available for a resident of a particular town.

One of the main contributions of this research is the calculation of the variables used in the Food Retail ranking. The previous literature has used measures of retail density such as the total square footage of supermarkets within a given town boundaries divided by the total population within the same town boundary as a variable for food retail outlets. This measure of food retail outlets, however, only considers the stores within a town and does not consider options in neighboring towns. Furthermore, this measure does not consider where population centers exist within a given town and thus treats equally the accessibility to food within different sections of a town that may contain, for example, a large state park on one end and a dense population on the opposite end. In our research we eliminate the town boundaries and start from a census block group centroid, a much smaller level of geographic area. Doing this allows our research to reflect where people actually live and the fact that individuals do not consider town (political) boundaries when determining where to shop for food.

Using GIS we map each centroid throughout the state as a place of population to then calculate the distance to the closest supermarket, grocery store, mass merchandiser, and wholesale club. Distances are calculated as the number of miles and the number of minutes using the ArcGIS Network Analyst which uses actual roadways to account for variations in driving conditions (e.g. faster speeds on highway versus slower speeds on local roads) and natural physical barriers (e.g. one must use a bridge to get over waterways). We use this same method to also calculate the number of retail options available within both a 5 minute and 10 minute drive time. Once each of the distance and density measures are calculated we aggregate up to the town level using a population weighted average of each census block group in a given town. Using this measure gives a more accurate representation of the food retail options and geographic proximity to food that town residents face given the existing roadway infrastructure and a retailers decision to locate in neighboring, yet nearby, towns.

In addition to including supermarkets, grocery stores, mass merchandisers, and wholesale clubs, the Food Retail ranking also includes measures of fast food density within a town and local foods. The inclusion of fast food density was determined because it provides residents with quick meal options that are generally widely available. Alternatively, local food options are becoming more important within the food environment to provide healthy alternatives and so we consider if there exists a farmers market, community supported agriculture, or community farm, or farm stand within the town. It is important to note that we do not include any indicators of quality, either nutrition or freshness, or price. Both of these are important factors in providing access to healthy and affordable food but are not easily measured at local community (town) geographic areas as they would require substantial primary data collection.

3. *Food Assistance Ranking* - In this analysis we rank towns based on an examination of participation in public food assistance programs and availability of public bus transportation to determine how well town residents are being served.

The Food Assistance ranking focuses on the participation and availability of public programs.[1] The three major federally funded programs are the Supplemental Nutrition Assistance Program (SNAP), Special Supplemental Nutrition Program for Women, Infants, and

[1] We are unable to include private food assistance programs, such as food pantries and soup kitchens, because of inconsistent data collection among different private sources throughout the state.

Children (WIC), and school meal (breakfast, lunch, and summer) programs. Our focus here is to include measures of the participation or availability of such programs. For SNAP we focus on the percent of households with income below poverty that receive SNAP. While we recognize that this does not include all SNAP recipients, it can be a more accurate measure of participation than alternatives that try to determine eligibility of households with income greater than the poverty rate. Similarly, our measure of WIC participation is based on income eligible women, infants, and children, although once again we recognize that this is just an approximation based on data availability. The school meal programs are measured based on students receiving free and reduced price lunch and of those students those that also receive free and reduced price breakfast. Summer programs are also increasing in popularity to provide a meal during times that school is not in session. These can be open or closed programs depending on funding and eligibility. We also include the availability of public bus transportation in this ranking because this means of transportation is a publically available and funded means of increasing one's ability to get to food options.

Table 1. Variable Descriptions and Descriptive Statistics

Variable	Description	Source	Mean	Std. Dev.	Min	Max
Population At-Risk						
Median household income ($)	Median household income in 2010 dollars	1	$81,510.32	25713.72	28970	209630
% householder <25 years	Percent of occupied housing units with householder under 25 years	2	2.11%	0.03	0.00%	18.98%
% householder 65+ years	Percent of occupied housing units with householder 65 and older	3	22.96%	0.05	10.97%	40.89%
% female householder	Percent of households with only a female head of household	4	9.22%	0.04	2.45%	29.67%
% households with 5+ members	Percent of households with 5 or more people	5	8.57%	0.03	1.13%	20.01%
% households with children	Percent of households with one or more people under 18 years	6	33.85%	0.06	20.38%	50.95%
% households without car	Percent of occupied housing units without a car	7	8.49%	0.05	0.59%	32.08%
% 25+ pop <HS degree	Percent of population 25 and older with less than a high school degree	8	8.49%	0.05	0.59%	32.08%
% pop w/bachelors or higher	Percent of population 25+ with a bachelors degree or higher	9	37.66%	0.14	12.24%	81.33%
Child poverty rate	Percent of children under 18 with household income below poverty level	10	6.75%	0.08	0.00%	43.44%
Overall poverty rate	Percent of population with an income below the poverty level	11	5.67%	0.05	0.15%	32.13%
Unemployment rate	Percent of labor force that is unemployed	12	7.84%	0.02	5.00%	16.20%

continues…

Table 1. *continued.*

Variable	Description	Source	Mean	Std. Dev.	Min	Max
Food Retail						
Supermarket 10 min	Population weighted average number of supermarkets within a 10 minute drive time from town census block centroids	13	5.13	4.92	0.00	26.25
Supermarket 5 min	Population weighted average number of supermarkets within a 5 minute drive time from town census block centroids	14	1.36	1.59	0.00	9.76
Supermarket miles	Population weighted average number of miles from town census block centroids to nearest supermarket	15	3.07	2.20	0.59	13.74
Supermarket time	Population weighted average number of minutes from town census block centroids to nearest supermarket	16	5.74	3.72	1.21	21.26
Grocery 10 min	Population weighted average number of small grocers within a 10 minute drive time from town census block centroids	17	5.33	8.58	0.00	46.30
Grocery 5 min	Population weighted average number of small grocers within a 5 minute drive time from town census block centroids	18	1.52	3.43	0.00	25.19
Grocery miles	Population weighted average number of miles from town census block centroids to nearest small grocer	19	4.70	3.74	0.40	21.21
Grocery time	Population weighted average number of minutes from town census block centroids to nearest small grocer	20	8.49	6.12	0.83	35.18

continues…

Table 1. *continued.*

Variable	Description	Source	Mean	Std. Dev.	Min	Max
Mass Merchandiser miles	Population weighted average number of miles from town census block centroids to nearest mass merchandiser	21	4.73	3.38	0.66	15.48
Mass Merchandiser time	Population weighted average number of minutes from town census block centroids to nearest mass merchandiser	22	8.42	5.56	1.37	24.37
Mass Merchandiser 10 min	Population weighted average number of mass merchandisers within a 10 minute drive time from town census block centroids	23	1.02	1.33	0.00	5.58
Mass Merchandiser 5 min	Population weighted average number of mass merchandisers within a 5 minute drive time from town census block centroids	24	1.02	1.33	0.00	5.58
Wholesale Club miles	Population weighted average number of miles from town census block centroids to nearest wholesale club	25	10.26	6.56	1.48	31.79
Wholesale Club time	Population weighted average number of minutes from town census block centroids to nearest wholesale club	26	16.97	10.03	2.97	49.59
Wholesale Club 10 min	Population weighted average number of wholesale clubs within a 10 minute drive time from town census block centroids	27	0.40	0.59	0.00	2.35

continues…

Table 1. *continued.*

Variable	Description	Source	Mean	Std. Dev.	Min	Max
Wholesale Club 5 min	Population weighted average number of wholesale clubs within a 5 minute drive time from town census block centroids	28	0.10	0.23	0.00	1.34
Fast food	Number of major fast food restaurants per capita (includes McDonald's, Burger King, Subway, Taco Bell, Wendy's, Domino's, Pizza Hut, and Dunkin Donuts)	29	2.89E-04	2.35E-04	0	1.29E-03
Local foods	Binary variable for local foods (=1 if at least 1 farmer mkt, community farm, csa, or farm stand)	30	0.85	0.36	0	1
Food Assistance						
SNAP	Percent of households with income below poverty that received SNAP	31	22.45%	0.19	0.00%	100.00%
WIC	Percent of eligible women, infants, and children receiving WIC benefits	32	40.23%	0.25	0.00%	100.00%
Breakfast	Percent of free and reduced price lunch students receiving free and reduced price breakfast	33	14.70%	0.19	0.00%	78.20%
Lunch	Percent eligible for free and reduced school lunch	34	20.42%	0.20	1.20%	98.80%
Closed Summer	Binary variable for a closed summer nutrition program	35	0.08	0.28	0	1

continues…

Table 1. *continued.*

Variable	Description	Source	Mean	Std. Dev.	Min	Max
Open Summer	Binary variable for an open summer nutrition program	36	0.22	0.41	0	1
Bus	Binary variable for bus transportation (=1 if local public bus transportation exists in town)	37	0.67	0.47	0	1

Sources:

1	ACS 2006-2010
2--11	Authors calculations using data from ACS 2006-2010
12	CT Department of Labor, 2011
13-28	Authors calculation using data from Trade Dimensions, 2010
29	Authors calculation from mapquest.com and company websites, 2011
30	211ct.org, 2010
31-32	Authors calculations using data from ACS 2006-2010
33-34	CT Department of Education through End Hunger Connecticut!, 2010
35-36	CT Department of Education, 2011
37	ctrides.com, 2011

Data Analysis

Following Lopez, et al. (2008) and Bletzacker, et al. (2009) we use a principal component analysis to develop town rankings for all 169 towns in the State of Connecticut. The PCA is a multivariate transformation technique that is used to create a variable(s) based on a linear combination of multiple variables. Unlike other literature we do not use the PCA to inform the number of components that should exist from the data. We assume that a single component exists for each grouping of variables that were previously discussed; therefore, we are creating a single variable based on the entire group of variables identified in each ranking category in Table 1.

One of the key advantages to using the PCA is the ability to include highly collinear variables, which do exist in each of our rankings. Thus we start with a matrix of variables in each ranking category, where all variables are normalized to have mean zero and unit variance to avoid issues with differing units (Everitt and Dunn 1992).

After the initial PCA, we perform a varimax rotation of the first principal component to obtain uncorrelated components. Following Chatfield and Collin (1980) we also use the correlation matrix to calculate eigenvalues and eigenvectors so that each variable is given equal importance. Again, we retain the first component so that all variables are included in the ranking. Following this procedure we then compute weights for each of the variables. These weights are normalized such that they sum to 100 and are then used to calculate a score for each town. The relative score then creates a ranking of 1 to 169 for each ranking indicator.

In addition to computing the rankings for each town we also compute a Spearman rank correlation between the three different rankings. The Spearman rank correlation is a nonparametric measure of dependence between two variables that requires the assumption of a monotonic relationship of the data. In fact, our rankings range from 1 to 169 meet this criteria, making the Spearman rank correlation the perfect statistical tool for determining the degree of correlation between the three rankings.

RESULTS AND DISCUSSION

Variable Weighting

Table 2 provides the weights for each of the variables in the three rankings. These weights are used to produce a score and then ranking for each town. The first ranking we discuss is the Population At-Risk ranking. The higher the overall score the greater the ranking, i.e. the greater the likelihood that residents of the town will be food secure. Variables that positively affect a towns ranking include income, higher education, householders that are 65 or older, and larger households as well as those with children. Alternatively, younger and female headed households are negatively influencing a towns ranking. Higher levels of poverty and unemployment as well as the prevalence of adults without a high school degree or households without private vehicles all have a negative effect. All of the negatively weighted variables are known to adversely affect a households food security, while most of the positive variables are well known to positively affect a households level of food security. The only variables that tend to be mixed in the literature are the impacts on food security of older householders and larger households, although the positive weighting here is supported.

The variable weights for the second ranking, the Food Retail ranking, are also presented in Table 2. Here the higher the overall score the more accessible a town's population is to food retail opportunities. Variables that positively affect a towns ranking include the number of retailers (supermarket, grocery, mass merchandisers, and wholesale clubs) within 5 and 10 minute drive times, the number of fast food restaurants per capita, and the presence of local food options. These are consistent with expected results, i.e. the more options that exist for purchasing food at retail increases one's level of food security. Alternatively, town populations that need to travel greater distances to reach any type of food retailer experiences reduced levels of food security. While this ranking does not consider public or private transportation to reach these food retailers, that is obviously a compounding effect on the association between increased distance to retailers and lower levels of food security.

Table 2. Variable Weights for Generating Scores

Variable	Weight	Variable	Weight
1) Population At-Risk		2) Food Retail	
Median household income ($)	0.91	Mass Merchandiser 10 min	0.54
% pop w/bachelors or higher	0.76	Mass Merchandiser 5 min	0.54
% households with children	0.60	Wholesale Club 10 min	0.42
% households with 5+ members	0.46	Supermarket 10 min	0.41
% householder 65+ years	0.02	Supermarket 5 min	0.40
		Grocery 10 min	0.33
% householder <25 years	-0.45	Wholesale Club 5 min	0.33
% households without car	-0.47	Grocery 5 min	0.33
% female householder	-0.52	Fast food	0.15
Child poverty rate	-0.54	Local foods	0.03
Overall poverty rate	-0.56		
Unemployment rate	-0.60	Grocery miles	-0.28
% 25+ pop <HS degree	-0.64	Wholesale Club miles	-0.29
		Supermarket miles	-0.29
3) Food Assistance		Grocery time	-0.29
Lunch	0.27	Wholesale Club time	-0.30
Open Summer	0.19	Supermarket time	-0.30
Breakfast	0.19	Mass Merchandiser miles	-0.36
SNAP	0.17	Mass Merchandiser time	-0.37
Closed Summer	0.08		
Bus	0.05		
WIC	0.04		

Source: Authors Calculations

The third ranking, the Food Assistance ranking, presents some interesting results. A higher score for this ranking is interpreted as a greater level of participation and/or availability of public food assistance programs and public bus transportation. The PCA methods resulted in all positive weights for these series of variables, which is consistent with expected results. Greater participation in programs and the availability of additional resources all increase ones level of food security which is captured by these weights.

Maps

While the weights that were just discussed produce rankings from 1 to 169, we also produce a series of maps from the results to allow for easier comparison amongst neighboring and different towns. Each map, shown in Figures 1-3, is color coded based on a quartile split of the rankings, where the top 43 towns are included in the 1st quartile (top 25%), the next 42 towns in the 2nd quartile, then 42 towns in the 3rd quartile, followed by 42 towns in the 4th quartile (bottom 25%). For all of the maps one can interpret the green color (top 25%) as a town's population is more likely to be food secure (or less likely to be food insecure).

As one can see, towns do not always fall in the same quartile for all three maps. Furthermore, there are obvious trends that start to develop in looking at the clustering of colors on the maps. For example, in Figure 1, the more rural northeast section of the state has a greater likelihood of being at-risk for food insecurity, while the opposite is true for the higher income suburban areas on the southwest part of the state. One can also then identify towns that do not follow the similar pattern, such as Danbury and Norwalk in the southwest and Scotland and Ledyard in the east.

Figure 2 shows the Food Retail rankings where even greater clustering is apparent. In fact, if one overlays a map of the Interstate Highway system one will find that I-95 along the East-West southern part of the state and I-91 along the North-South middle part of the state runs right through many of the towns with greater food retail access. The parallel to the highway system is certainly not surprising, but other clusters of red have gained some attention by policy makers.

The Food Assistance rankings displayed in Figure 3 again show clustering and neighboring disparities. Here the cluster of green is in the northeast section of the state that was previously red in the Population At-Risk ranking. This comparison is an important result that shows how these rankings can be used jointly to better understand a town's level of CFS. In the case of the northeast section of the state, one might consider the interpretation that a higher risk of food insecurity exists but there are available public resources that are being utilized to help offset the potential hardship. One might further express concern, however, when also

considering the Food Retail opportunities in that region that are more limited relative to other parts of the state.

Figure 1. Population At-Risk Ranking:
Measuring the likelihood a resident is at-risk for food insecurity

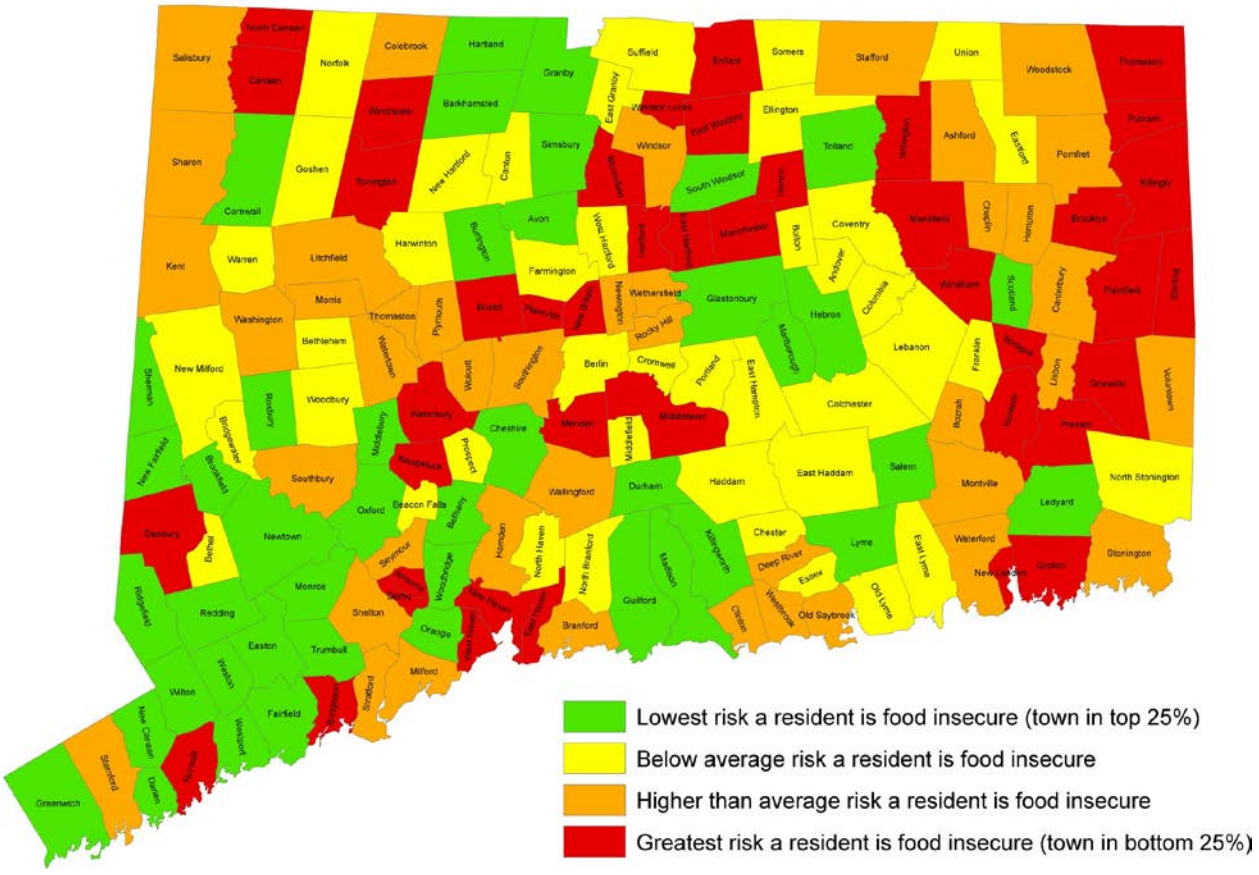


Figure 2. Food Retail Ranking:
Measuring the proximity and food retail options for consumers

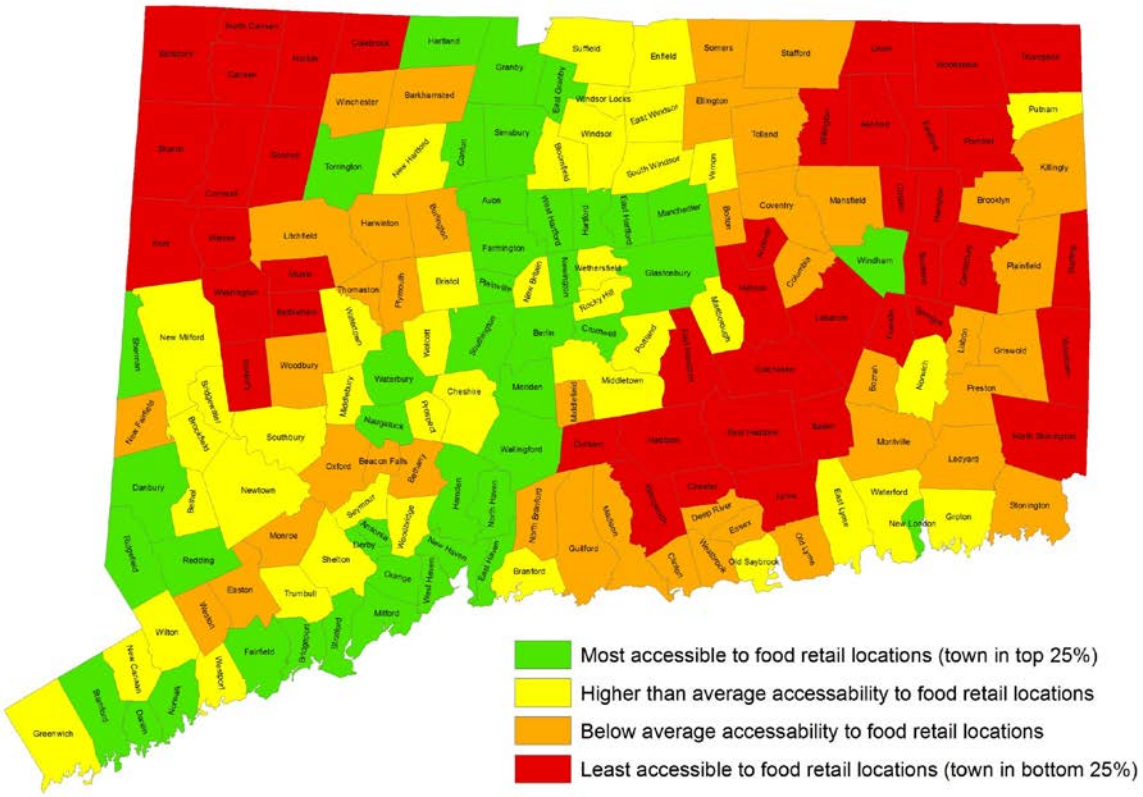
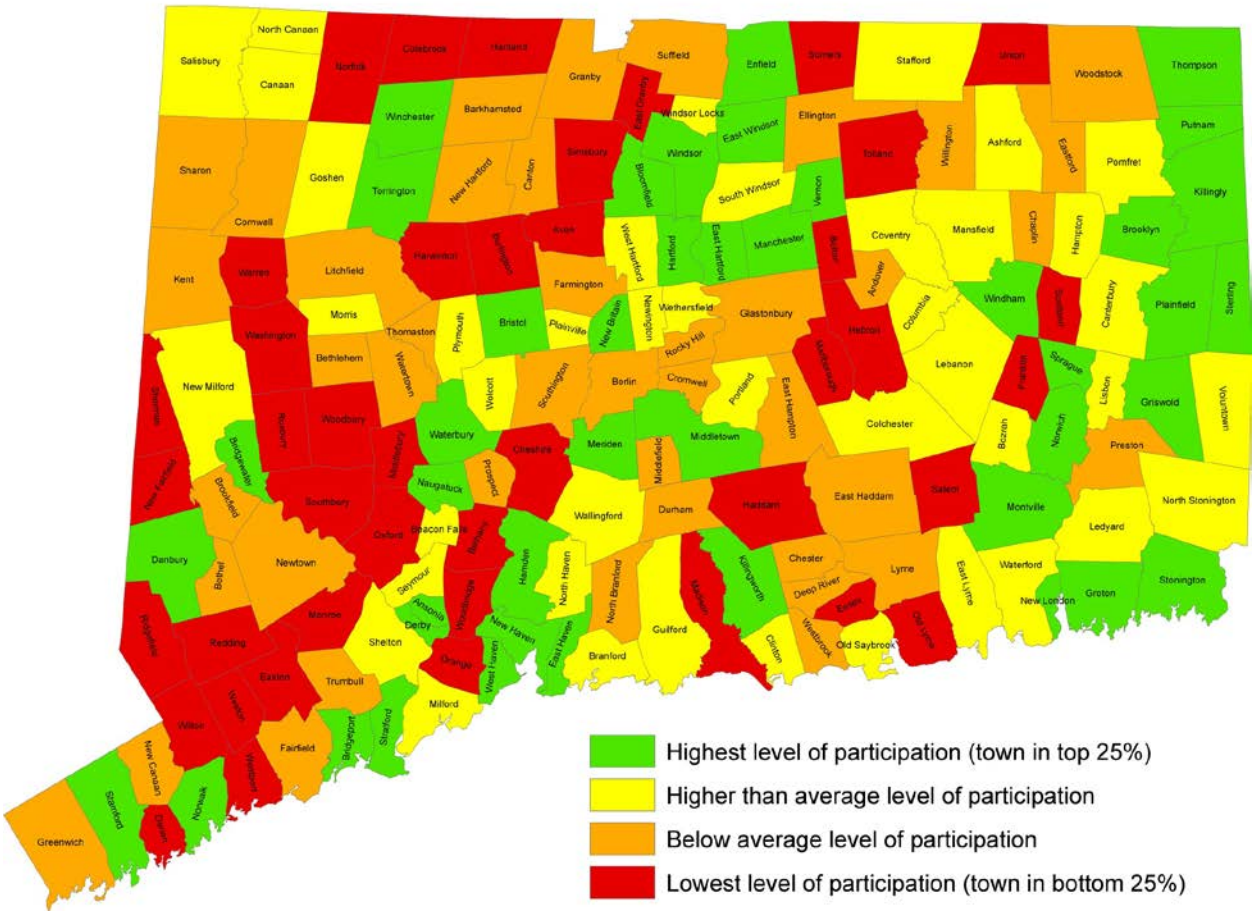


Figure 3. Food Assistance Ranking:
Measuring how well residents are being served through selected public services



Overall these rankings are useful for evaluating relative need and performance between towns. It is important to keep in mind with this research that all rankings are relative to other towns in the state. This means that this approach necessitates that one quarter of the towns will rank in the bottom quartile. A town which ranks in the bottom quartile, therefore, may be performing poorly relative to other towns in the state, but our study makes no attempt to measure how a town is performing relative to the region or nation. It is quite possible that a town performing poorly relative to other towns in the state is still more food secure than other regions in the nation.

Spearmen Rank Correlation

Spearman Rank correlations between the three different ranking groups are shown in Table 3. Not surprisingly, the Population At-Risk and Food Assistance rankings are correlated at -80.27%, a result that is statistically significant at the 1% level. This means that a town that ranks low (closer to 1) in Food Assistance is 80% more likely to rank high (closer to 169) in Population At-Risk. In other words, towns that have populations at greater risk for food insecurity are also participating more in public food assistance programs. This is consistent with Nord (2001) who finds that participation in food assistance programs is greater by eligible populations in poorer towns (i.e. those at greater risk for food insecurity).

Table 3. Spearman Rank Correlation

	Population At-Risk	Food Retail	Food Assistance
Population At-Risk	1.00		
Food Retail	-0.1507**	1.00	
Food Assistance	-0.8027***	0.2819***	1.00

, * = correlation is significant at the 0.05 and 0.01 level, respectively.

The other two correlations, Food Retail versus Population At-Risk and Food Assistance versus Food Retail, are both very low correlations, although both are statistically significant at the 5% and 1% levels, respectively. Thus a low ranking (closer to 1) in Food Retail is only 15% more likely to rank high (closer to 169) in the Population At-Risk. A low ranking (closer to 1) in Food Assistance is only 28% more likely to rank low (closer to 1) in Food Retail.

General Discussion

While our study is important in identifying a modification to a rapid assessment method of measuring CFS, there are some limitations that we must recognize. With respect to the Population At-Risk Ranking, there is no consideration for the racial composition of town residents. We intentionally do not consider this the socioeconomic makeup of the ranking structure because our intent is to focus more on areas that cause food insecurity rather than those

that are just correlated with food insecurity. One of the key limitations of the Food Retail ranking is the lack of information on price, freshness, and nutritional quality. Unfortunately secondary data sources do not exist that can provide measurements of these variables throughout all towns in the state. Thus it would be necessary to embark on a costly and time intensive primary data collection process. This process is best focused on areas where there is a concern that is already identified to measure the degree of concern in the community. Our results can help guide that decision process. For the Food Assistance rankings, we provide no information about the quality of food assistance programs. We also recognize that low levels of participation in public assistance programs may be a result of various obstacles in accessing these programs, such as lack of knowledge, difficulty navigating program enrollment, uncertainty about eligibility, and stigma associated with identification of receiving benefits.

While this study provides an excellent tool for measuring CFS across the state (or even region or nation) it is only a first step in the process of understanding the true level of food security in a community. For a more comprehensive understanding of truly local levels of CFS a community must embark on its own process of evaluation, dialogue, and planning to arrive at a community-based strategy to improve access and availability of food. Community-focused strategies should be highly engaging and participatory, including municipal officials, non-profits, private businesses, and residents. An important tool to consider is a Community Food Assessment, which serves as a mechanism to foster a community planning process and respond to community food security needs.

While many municipalities may be concerned about food waste, food is rarely high on the agenda of most town planners, economic development commissions, civic or environmental groups. Anti-hunger organizations play an important role in meeting the short-term needs of food insecure residents, but readily acknowledge their work does not alter underlying socioeconomic challenges. On the other hand, the public's growing interest in safe and healthy food is fertile ground for creative and dynamic leaders as well as considerable local energy focused on the goals of community food security. In recent years there have been many groups throughout the U.S. that are concerned with food and/or agriculture related issues (food policy councils, town agriculture commissions, farmers market associations, school wellness committees, and community kitchen advocates) who aim to promote healthy, fresh, local food and support viable

agriculture. These types of organizations can help form a backbone to community food security strategies.

Community food security strategies also tend to focus less on emergency food access and more on availability of affordable and healthy food that will meet long-term needs. Some examples of community food security strategies are:

- Creating incentives for a new neighborhood retail food store;
- Encouraging the use of abandoned structures and brownfields for the construction of food hubs, food processing centers, or urban agriculture enterprises;
- Adding bus transportation to public food assistance agency offices;
- Creating better meal options in school cafeterias to address child obesity;
- Offering community garden plots and gardening assistance so residents can grow their own food;
- Launching a new farmers market to bring local farm products closer to residents;
- Creating a composting program to reduce food waste and provide affordable soil amendments for gardening purposes.

With an initial rapid assessment that identifies the relative levels of food security across a geographic area one can prioritize where the strategy conversation will progress.

CONCLUSION

Ultimately this research has the potential to generate significant policy related discussion on issues of food insecurity, food access, and utilization of food assistance programs. The limited literature that exists in the area of community food security has identified the need and usefulness of a rapid assessment methodology to assess the issue. Unfortunately, the existing methodology has left policy makers and stakeholders with little ability to utilize the analysis in an effective way because of the complexity and multi-dimensionality of community food

security. By isolating the components of the assessment method and improving the measurement technique we are able to improve usability of the methodology and increase the likelihood of impacting policy discussions by providing timely and useable information to parties involved in the policy making process. As a starter to the conversation, this approach has the potential to lead to identification of communities with specific needs and areas for further localized research.

We also acknowledge and recognize that strategies to address food security do not always restrict themselves within town boundaries. Nor do towns or residents always have a great deal of control over where or how food is produced, sold, priced, prepared or consumed. Nevertheless, we hope these results will be used to stimulate town-level discussion and considerations, and may even help prioritize further analysis and commitment to strategies that will strengthen community food security.

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