



## **Patterns of Food Insecurity, Food Availability, and Health Outcomes among Rural and Urban Counties**

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### EXECUTIVE SUMMARY

**Purpose:** Food insecurity means that the food intake of one or more household residents was reduced and eating patterns disrupted because the household lacked money and other resources for food. This study developed estimates of food insecurity risk for U.S. counties and examined associations between food insecurity risk, behaviors related to food insecurity risk, and health outcomes. We focused especially on variations in patterns of food insecurity across the rural-urban spectrum.

**Methods:** We identified seven county measures related to a state-level measure of food insecurity. Every county's score on these measures was expressed on a common scale, and summed across measures to obtain one additive county-level food insecurity risk score. Risk scores were analyzed to examine variations across rural-urban areas and regions throughout the nation. The USDA Rural-Urban Continuum Codes were used to define and differentiate rural vs. urban counties, resulting in a 9-category classification scheme. We tested linear correlations at the county level between the food insecurity risk score and several health and behavioral outcomes, including a diet with less than five servings per day of fruits and vegetables, no leisure-time physical activity, current smoking rate, adult diabetes rate, adult obesity prevalence, and age-adjusted death rates for heart disease, all-site cancers, and stroke.

**Results:** Rural counties have more food insecurity relative to metropolitan counties (see Figure 1). Risk of food insecurity increases from a score below -2 to one above 1.5 as counties become more rural along the rural-urban continuum (higher scores indicate greater insecurity). Risk of food insecurity is highly variable across U.S. counties although a number of regions show significant clustering (see Figure 2). Statistically significant associations at the county level ( $p < .0001$ ) were obtained between food insecurity risk and diabetes, obesity, no leisure time for physical activity, less than five servings per day of fruits and vegetables, and smoking rate. No statistically significant county-level associations were found overall nationwide between food insecurity risk and death rates. County-level results from the regional analyses, however, showed significant correlations between food insecurity and health, and behavioral outcomes for specific types of mortality in some regions. The Full Report companion to this Brief describes findings in more detail.

**Conclusions:** Rural counties, compared to metropolitan counties, are disproportionately associated with high food insecurity risk. Programs and policies such as food access policies that are included in the Farm Bill, or the Let's Move campaign, may focus on improving food availability and access for rural populations.

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## **BACKGROUND**

This study examines food insecurity, develops a food insecurity risk score for United States (U.S.) counties, analyzes results across rural-urban counties, and explores the relationship between county food insecurity risk scores and health behaviors and outcomes.

For the purposes this study, food insecurity is operationally defined as follows: the food intake of one or more household residents was reduced and their eating patterns disrupted because the household lacked finances and other resources for adequate food.<sup>1</sup> In 2007, 11.1% of U.S. households were food insecure at least some time during the year.<sup>2</sup> In 2008, the national average of food insecure households increased to 14.6%.

Often in rural areas, food is most accessible at convenience stores and fast food outlets with consequent reductions in healthy food options. As a result, rural residents have limited access to low-cost supermarkets, and prices in rural supercenters that are accessible to residents are frequently higher for the majority of fresh fruits and vegetables, dairy items, and less refined/processed food items compared to urban areas.<sup>3,4</sup> These findings depict a rural environment lacking easy access to nutritive-dense, healthy, low-cost foods.

Lack of access to nutritive-dense, healthy foods leads to diets high in fat. Diets high in fats increase the prevalence of obesity. Obesity is associated with the development of type 2 diabetes.<sup>5</sup> Further, obesity results in increased risks of cardiovascular and cerebrovascular disease. Household food insecurity prevalence has also been linked to impaired psychological health, lower levels of reported life satisfaction, higher self-reported stress, unmet health care needs, use of tobacco products, and higher incidences of stroke and diabetes.<sup>6</sup> The extensive list of potential negative outcomes associated with food insecurity makes it imperative to understand its distribution in rural and urban settings so that appropriate policy decisions can be made to reduce food insecurity.

In this study, we derive estimates of food insecurity risk for U.S. counties and examine associations between food insecurity risk, behaviors related to food insecurity risk, and health outcomes that may be affected by food insecurity. This study can inform policy-level decision-making by describing how food insecurity is related to health issues in rural areas.

## **METHODS**

### **Design and Measures**

Rural-urban counties were classified using the nine categories in the U.S. Department of Agriculture's (USDA) Economic Research Service (ERS) rural-urban continuum codes shown in Table 1.<sup>7</sup>

**Table 1: Rural-Urban Continuum Code Descriptions\***

<b>Rural-Urban Continuum Code</b>	<b>Description</b>
<b>1</b>	County in metro area with 1 million population or more
<b>2</b>	County in metro area of 250,000 to 1 million population
<b>3</b>	County in metro area of fewer than 250,000 population
<b>4</b>	Nonmetro county with urban population of 20,000 or more, adjacent to a metro area
<b>5</b>	Nonmetro county with urban population of 20,000 or more, not adjacent to a metro area
<b>6</b>	Nonmetro county with urban population of 2,500-19,999, adjacent to a metro area
<b>7</b>	Nonmetro county with urban population of 2,500-19,999, not adjacent to a metro area
<b>8</b>	Nonmetro county completely rural or less than 2,500 urban population, adj. to metro area
<b>9</b>	Nonmetro county completely rural or less than 2,500 urban population, not adj. to metro area

\*Note that the scale tends to move from more urban to more rural, but is not strictly ranked and constitutes a nominal rather than an ordinal scale.

We used the ERS Food Environment Atlas state-level data on food security based on the Current Population Survey food insecurity questionnaires for the initial state level food insecurity estimates.<sup>8</sup> In addition, a broad range of county-level variables were available through the Food Environment Atlas that included food environment, food access, and related health outcome measures.

Based on a literature review of factors contributing to food insecurity, including factors cited in an ERS study of food insecurity,<sup>9</sup> we developed a list of seven county variables that were in the Food Environment Atlas and that were correlated to the state-level food security variable in that higher scores of the county variable were correlated to higher scores of the state food insecurity measure. The seven county indicators were:

- Percentage of county residents with household income below the federal poverty threshold based on 2008 U.S. Census data.
- Ratio of median home value to median household income (to reflect variations in the cost-of-living across counties).
- Percentage of people at or below 200% of the federal poverty level who are receiving Supplemental Nutrition Assistance Program, formerly Food Stamp Program benefits based on 2006 data.
- Percentage of housing units in a county that are more than one mile from a supermarket or large grocery store and that have no car. This variable represents 2006 data for stores, and 2000 data for households.
- Percentage of the population that is less than 200% of the federal poverty level for family size and lives more than one mile from a supermarket or grocery store. Again, 2006 data are for stores and 2000 data for households.
- Number of grocery stores per 1,000 population. Store data are from the U.S. Census Bureau, County Business Patterns; and 2007 population data are from the U.S. Census Bureau, Population Estimates. Convenience stores are excluded, as well as large general merchandise stores that also sell food, so that only grocery stores offering the full range of foods including fresh produce, dairy products, and less processed foods are included.
- Direct farm sales in dollars per capita. Market data and population data are examined for 2007. This variable accounts for food sales directly to individuals from sources such as farmers markets, community supported agriculture (CSA) operations, farm stands, and/or pick-your-own operations, among others.

### **The Food Insecurity Risk Score**

Mean scores were calculated for each of the seven county indicators. We then constructed a standardized county-level food insecurity risk score by (1) subtracting the county value for each indicator from its national mean; (2) dividing the result by the standard deviation for the national indicator; and (3) multiplying the result by -1. (This last step generated a scale with a midrange point of 0, where 0 reflects average food insecurity. Positive scores indicated greater food insecurity, while negative scores reflected less food insecurity.) Three variables were reverse-scored in the algorithm so that higher scores for all indicators reflected greater food insecurity: grocery stores/1,000 population, direct farm sales per capita, and median home value/household income ratio. The final food insecurity risk score for each county was obtained by summing the scores across all seven indicators for that county; a higher score on this scale indicated larger levels of food insecurity.

### **Analyses**

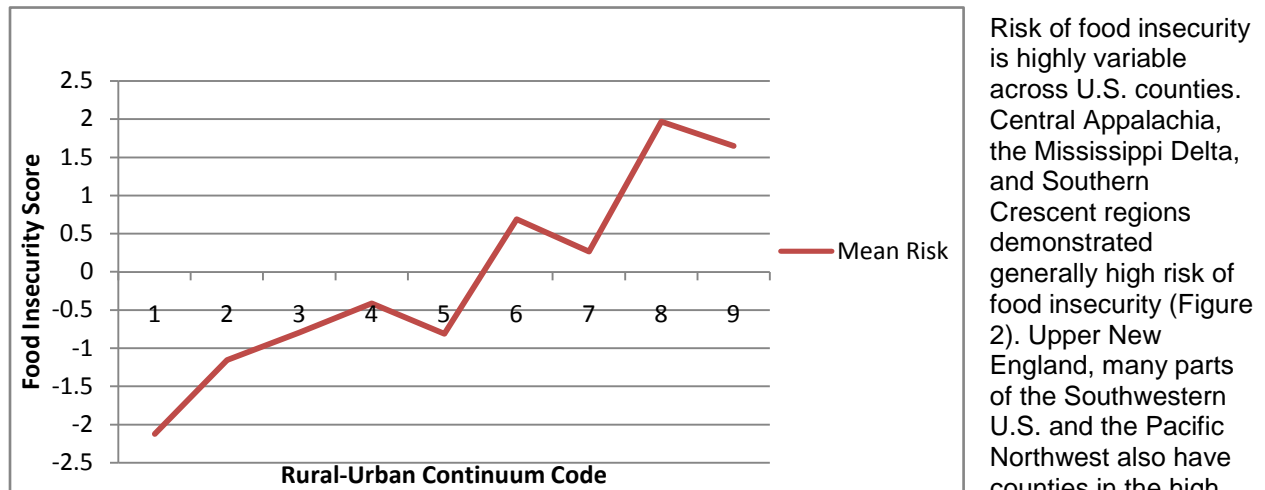
Descriptive analyses explored the food insecurity risk score across all counties nationwide, across counties defined by region, and by rural-urban continuum code. We examined bivariate linear associations between the food insecurity risk score and key health behaviors and outcomes that may be related to food insecurity. Three behavioral variables were examined: (1) a diet with less than five servings per day of fruits and vegetables, (2) no leisure-time for physical activity, and (3) current smoking rate. Five health outcome variables were selected: adult diabetes prevalence, adult obesity prevalence, and age-adjusted death rates for heart disease, all-site cancers, and stroke. Data for the mortality variables were generated using individual death certificate data obtained from the National Center for Health Statistics<sup>10</sup> and population denominators from the U.S. Census.<sup>11</sup> Mortality data were aggregated

over the period 1995-2001 to improve the likelihood of generating stable and reliable estimates. One analysis used all counties in the nation, and the other analyses examined regional subsets of counties based on U.S. Census divisions to explore possible regional cultural differences related to food preferences or physical activity.

## RESULTS

Figure 1 indicates that rural counties exhibited higher levels of food insecurity relative to metropolitan counterparts. Risk of food insecurity increases from a score below -2 to one above 1.5 as counties become more rural along the rural-urban continuum

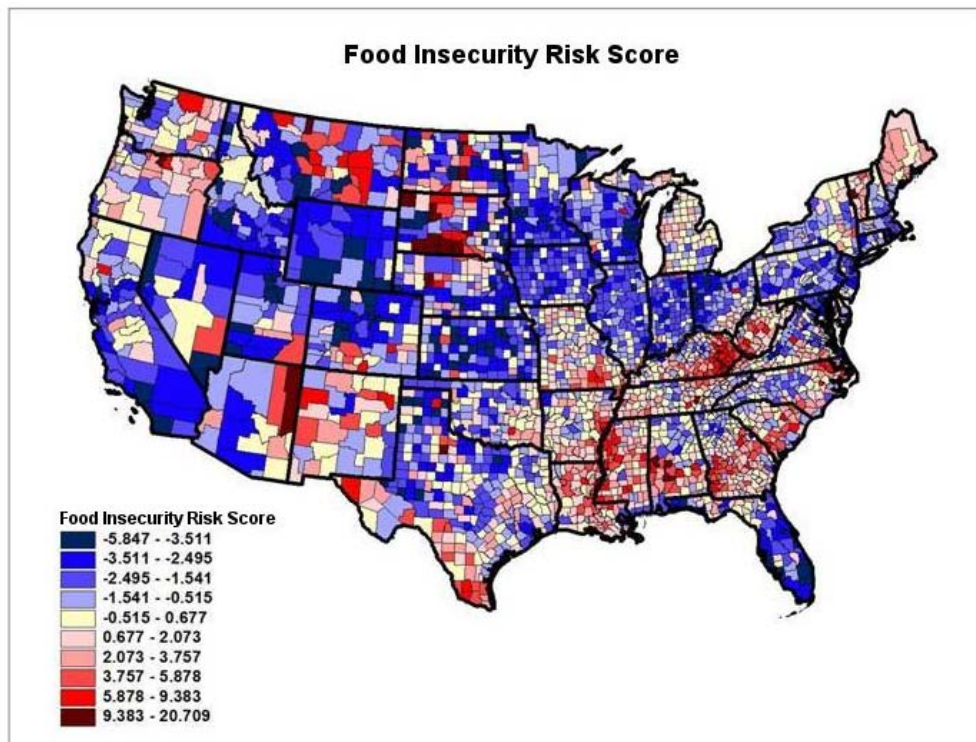
**Figure 1:** Mean Food Insecurity Risk by Rural-Urban Status (range 1 = “most urban” to 9 = “most rural”).



Risk of food insecurity is highly variable across U.S. counties. Central Appalachia, the Mississippi Delta, and Southern Crescent regions demonstrated generally high risk of food insecurity (Figure 2). Upper New England, many parts of the Southwestern U.S. and the Pacific Northwest also have counties in the high

food insecurity categories. By contrast, counties in several states (e.g., Florida, Indiana, Illinois, Wyoming, Wisconsin, and Iowa) are almost all within the low risk categories.

**Figure 2:** Food Insecurity Risk Score. Higher scores indicate higher food insecurity.



Results of the national bivariate analyses show significant, associations ( $p < .0001$ ) between food insecurity risk and five of the behavioral and health outcomes, namely, diabetes, obesity, no leisure time for physical activity, less than five servings per day of fruits and vegetables, and smoking rate. At the national level, no statistically significant associations were found between food insecurity risk

and death rates. Results from the regional analyses, however, were highly variable and included significant associations between food insecurity risk and behavior and death rate outcomes. Details about the national results and regional variations in statistical relationships among study variables are available in the full report that accompanies this Brief.

## **SUMMARY AND CONCLUSIONS**

This study describes the degree of food insecurity risk among rural and urban counties, and how this degree of risk is related to a host of important behavioral and health outcomes. To consistently and accurately assess the degree of food insecurity risk among counties, we developed an algorithm to estimate food insecurity at the county level. The algorithm generated a standard scale on which to order counties by degree of food insecurity, which can be used to identify high-risk areas relative to food-insecurity so that interventions can be introduced to improve access and availability of high quality foods.

Rural counties are disproportionately associated with high risk food insecurity relative to urban counties. Programs and policies might prevail to improve food access for rural populations. Particular attention might be paid to the food infrastructure in rural environments; areas of focus are likely to include policies to increase local food availability in rural agricultural environments, school- or community-based nutrition education programs, and policies to promote greater availability of healthy food choices through tax incentives or targeted food infrastructure investments to geographic areas of greatest need. Existing policies such as the Let's Move campaign or Farm Bill provisions to improve food access in underserved populations may help improve access. Future research, with multivariate analyses across regions can shed additional light on the impact of food insecurity on the health of the population, especially for those living in rural areas nationwide and in different regions.

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## **Additional Information**

See the Full Report that corresponds to this Brief for more detailed methods and findings from this study at: <http://wvrhrc.hsc.wvu.edu/projects/2010/halverson/>