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Accessing Food in Rural Food Deserts in Iowa and Minnesota

Lois Wright Morton*

Chery Smith**

Abstract The purpose of this research is to examine the food infrastructure (grocery stores and food safety net services) available to meet the food needs of people living in high poverty rural places. Random mail surveys (n=1,516), purposeful in-person surveys (n=665), and market basket food price surveys of 130 USDA Thrifty Food Plan items in 16 grocery stores in six rural counties in Iowa and Minnesota provide data for this analysis. We find that Iowa rural users of food safety net services are more likely to depend on others to get to the grocery store (5.6-6.2%) compared to similar population in Minnesota (3.1-3.5%). The general rural population is more likely to perceive local institutions are working together to solve food access problems than users of food safety net services. Minnesota average rural food prices are significantly higher than in rural Iowa grocery stores during similar time periods. Minnesota stores have significantly more costly fresh fruits and vegetables, canned fruits and vegetables, breads and cereal, milk and dairy products and meat and meat alternatives. We conclude that rural residents may share similar food infrastructure but experience it differently depending on income, food insecurity, food prices, transportation and how local government and church leadership engage in solving community food problems.

INTRODUCTION

While it is commonly accepted that individual behaviors, finances, personal poverty and personal work patterns influence ability to purchase foods, the role of the food infrastructure specifically the grocery store and its association with rural residents' ability to acquire foods is less understood. Issues of access to the normal food system (Campbell 1991; Morris, Neuhauser and Campbell 1992) are framed by the distribution of grocery stores across the

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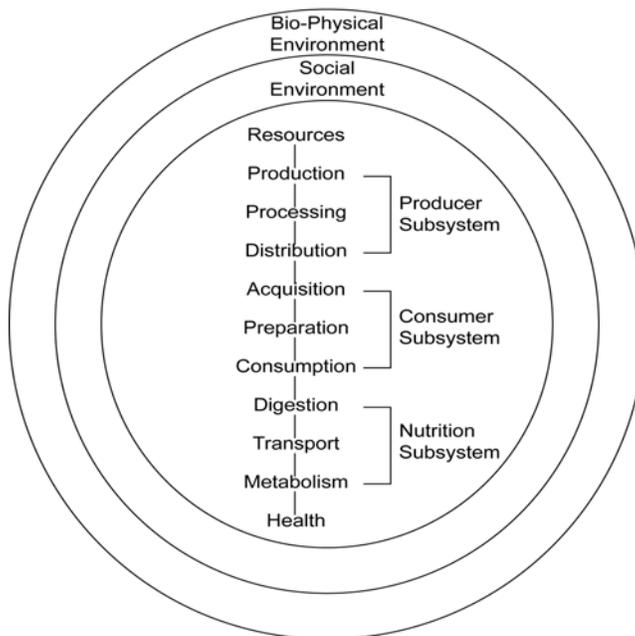
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landscape. The physical organization of the food environment is one of the contextual conditions that are thought to influence variations in health and well being (MacIntyre, Ellaway and Cummins 2002; Whelan, Wrigley, Warm and Cannings 2002).

Places with few or no grocery stores have been labeled “food deserts” by a number of policymakers and scientists (Lang and Caraher 2002; Morton, Bitto, Oakland and Sand 2005; Morton and Blanchard 2007; Whitehead 1998). Originally used in Great Britain, the term is associated with the consolidation of the retail food industry (larger stores but fewer) and the loss of smaller neighborhood food stores (Kaufman 2000; Lang and Rayner 2002; Leland 1987; Whelan et al. 2002). The effects of retail food industry consolidation in rural U.S. areas have resulted in similar patterns: fewer local grocery stores, increased consumer travel distances to larger regional stores, loss of a community institution where social connections are made, and economic loss of a local business that contributes to the tax base.

The Food and Nutrition System Model (Figure 1) posited by Sobal, Khan and Bisogni (1998) identifies a complex set of activities which are involved in providing food for sustenance and nutrients for maintaining health. A large portion of this system is structural, consisting of the bio-physical environment, the social environment, resources, producer and consumer subsystems. The composition of processed food and the safety of food have changed dramatically the variety of foods available with the globalization of the producer subsystem. However, despite the expansion of global food systems, consumer acquisition continues to have a strong spatial orientation. The place-based locations and food prices of grocery stores and supermarkets (e.g. the normal food system (Campbell 1991)) where foods are purchased relative to consumers’ place of residences and work have important implications for how foods are accessed, food insecurity and the health and well-being of rural households.

Figure 1 A conceptual model of the food and nutrition system



Source Reprinted from *Social Science Medicine* 47(7):853-63, Jeffery Sobal, Laura K. Khan, Carole A. Bisogni, "A conceptual model of the food and nutrition system," 1998 with permission from Elsevier.

In this paper we examine the rural food infrastructure available to meet food needs of people living in high poverty counties in Minnesota and Iowa. Using a mixed research design we integrate findings from a random sample survey of rural residents, surveys of rural users of food safety net services, and grocery store food price surveys to construct a picture of rural food access. We first discuss food access and price patterns and then turn to food insecurity and the social organization of rural places which influences how communities solve food problems. Next we report on the results of data collected on rural households. Lastly implications of our findings are presented.

Food Access and Price

The health behavior and promotion literatures acknowledge that the social and physical environmental context in which people choose healthy lifestyles influence health and well-being (Cockerham 2005; Mirowsky and Ross 2003). However research on causality and models of change and intervention are dominated by a focus on individually constructed behaviors rather than the structural forces (Cockerham 2005; MacIntyre et al. 2002). Under individual choice models the inability to acquire an adequate supply of household foods in the normal food system is a personal and household financial issue rather than one of community infrastructure. Cockerham proposes that "...there are situations in which structure can be so overwhelming that agency is rendered ineffective" (Cockerham 2005:54). Thus, while individuals can choose or modify food acquisition patterns, structural conditions can severely limit the available options. These structural conditions include the location of grocery stores, food prices, and transportation infrastructure or lack thereof. Morton et al. (2005:96) writes, "While food deserts may not be the source of food insecurity, they frame the conditions under which disadvantaged communities and households must expend greater resources to obtain food through normal sources." Food deserts are the circumstances within which people live (Lang and Caraher 1998).

In rural areas consolidation of the grocery industry has meant small town food store closures and increased travel distances to food stores (Bitto, Morton, Oakland and Sand 2003; Morton et al. 2005). Morris et al. (1992) find that poor households in rural places have fewer store options and travel longer distances to supermarkets than urban households. They also report that in 51 supermarkets and 82 small/medium stores in 33 nonmetro counties that the average cost of USDA Thrifty Food Plan (TFP) market basket items were more costly in small/medium stores than in supermarkets (Morris et al. 1992). In a more recent but smaller study of food prices in 14 rural stores using the TFP market basket of items Morton (2006) and

Morton and Blanchard (2007) find that regional rural Wal-Mart super stores' frozen juices, most breads and cereals, meats and meat alternatives, sugars and sweets and canned fruits and vegetables were less expensive or competitively priced compared to smaller grocery stores located 21 to 63 miles away from the rural resident's home. Garasky, Morton and Greder (2006:83) find that "high local food prices and an inadequate number of food stores are viewed by families as obstacles to meeting their food needs."

Consolidation of retail food stores, changing patterns of food distribution and where consumers go to acquire their daily food supply simply means that most of the rural population must develop new patterns of travel to purchase the household groceries (Bitto et al. 2003; Morton et al. 2005). However in rural places with pockets of high poverty, high proportions of elderly, little or no public transportation, loss of a local grocery store and replacement by a large regional supermarket increase the impacts on food access. Lang and Caraher (1998) in discussing the complexity of food divisions in society find that they are associated with poor access to food, transportation, and low incomes.

Food Insecurity, Diets, and Health

Food access is a key component of food security (Anderson 1990). Food security definitions of access to food for all have two structural qualifiers: socially acceptable access and nutritional adequacy access (Anderson 1990). Social acceptability strongly implicates access to the normal food system as a central condition of food security. Grocery store location, food prices and the costs associated with traveling to the store can indirectly influence the degree of food security or insecurity a household experiences.

Household food insecurity has been measured by both single and multiple-items (Bickel, Nord, Price, Hamilton and Cook 2000; Frongillo, Rauschenback, Olson, Kendall and Colmenares 1997). The National Health and Nutrition Examination Survey (NHANES) and the Continuing

Survey of Food Intake by Individuals (CSFII) use a single question with a three (NHANES) and four (CSFII) point likert scale responses to represent the range from food secure to severe food insecurity (Frongillo et al. 1997; Sahyoun and Basiotis 2001; Townsend, Pearson, Love, Achterberg and Murphy 2001). United States Department of Agriculture (USDA) food and nutrition researchers have developed 18 and 6-item core questions for use in assessing U.S. household food insecurity (Bickel et al. 2000). These instruments are used by USDA to measure food secure households and prevalence of household food insecurity and hunger trends over time at national and state levels.

Both Minnesota and Iowa reported higher household food secure rates (92.9 percent and 90.5 percent respectively) than the overall U.S. average (89.0 percent) during the time period of our study (2002-03) (Nord, Andrews and Carlson 2003). Food insecurity rates ranged from 9.5 percent (Iowa) to 7.1 percent (Minnesota) compared to the U.S. average of 11 percent. However, state and national rates represent combined averages of urban and rural locations and mask variations across rural places. Poverty and economic disadvantage is associated with food insecurity (Sarlio-Lahteenhorva and Lahelma 2001) and is not evenly distributed across rural places or populations. Those living in high poverty rural locations often experience food insecurity at rates far higher than the state average (Morton, Oakland, Bitto and Sand 2004).

Foods vary in nutritional and caloric values. Nutritional access relates to the types of food available for purchase and their nutritional content. Diet and health connections have been and continue to be extensively studied to better understand the nutrition subsystem impacts (Sobal et al. 1998). According to the Sobal et al. (1998) model of the food and nutrition system (Figure 1) shifts in the consumer acquisition stage can indirectly influence consumption patterns and the nutrition subsystem that supports health. The price of foods is one factor in the

acquisition stage that is often associated with nutritional content. For example fresh fruits and vegetables have high nutritional values but short shelf lives, seasonal availability and are frequently higher priced per unit than processed foods such as pasta, rice, and canned vegetables. Olson, Rauschenback, Frongillo and Kendall (1997) report that in rural upstate New York limited access to supermarkets, decreased availability of fresh foods, and higher costs of foods increased the risk of food insecurity and poor diets.

Social Organization and Capacity to Solve Rural Food Problems

One of the outer rims on the Sobal et al (1998) nested model is labeled social environment. There is an emerging literature that offers evidence that the social structure of rural communities affects food security (Garasky et al. 2006; Morton et al. 2005; Sobal et al. 1998). Rural social infrastructure that targets solving food problems consists of various combinations of public programs such as food stamps and WIC (Women, Infants & Children) and specialized private not-for-profit organizations providing food pantries, emergency food, and meal sites for low income and elderly. Rural communities also have a variety of generalized community organizations such as service clubs, churches, and other organizations whose mission encompasses activities in support of community well being. Molnar, Duffy, Claxton and Bailey (2001) find that rural churches are major organizers of food banks and community-wide efforts to solve food insecurity. Morton et al. (2005:94) report that "residents living in poor rural counties with few grocery stores and perceptions of high civic structure are significantly less likely to be food insecure" compared to those living in places with perceived lower civic structure.

While Sobal et al. (1998) focus on social influence and personal systems of choice as critical determinants of food acquisition, the integrated nature of the model specifies the food retailer is a key factor. Thus there is an interdependency between producer-consumer

subsystems in the creation of food access, the human nutrition subsystem and ultimately health. What is not known is the extent to which living in rural areas with few or no grocery stores affects perceptions of food access, nutrition, health, well-being, and food insecurity. To begin to build a knowledge base, we ask what does the structure of food access look like in rural places? Are perceptions of access to a regular food supply place-specific or are there patterns across rural places? A number of low income households supplement access to the normal food system with trips to local food pantries/shelves and community meal sites. These food safety net services are important sources of food and extend household resources to meet family needs. To what extent do differences between users of rural food safety net services and the general population increase variations in food access?

METHODS

To answer these questions, two survey methodologies, one a random sample of the general public (four rural Iowa counties) and the second, purposeful surveys of rural food safety net users (four counties at or above average state poverty rates in Iowa and two counties above average state poverty rates in Minnesota) are utilized. In Iowa the random and food safety net users surveys overlap in two high poverty counties offering a comparison between the general population and food safety net users (Appendix A). Food safety net users were surveyed in person when they were accessing safety net services (food banks, meal sites, food stamp registration sites) on specifically selected days. The Iowa and Minnesota purposeful survey questionnaires were not worded identically but had a number of similar kinds of questions regarding how people access their food supply, how they solve the problems of food availability and quality, and their health and nutrition status. In addition to the surveys of rural perceptions of food in their community, food price surveys of 149 items in 16 local grocery stores (11 Iowa and 5 Minnesota) in the 6 study site counties were conducted in 2002-03.

Prices were gathered based on the USDA Thrift Plan market basket list of food items (see <http://www.extension.iastate.edu/hunger/foodprice.htm> for complete list of 149 food items).

Counties in Iowa and Minnesota were selected in 2001 for study based on a definition of rural, potential to be a food desert, and poverty rates above their respective state average. Counties were defined as a food desert if they had four or fewer grocery stores (Morris et al. 1992; Morton et al. 2005). According to 1997 Standard Industrial Classification (SIC), 13 of 99 counties in Iowa and 11 of 87 counties in Minnesota met this criterion. Next, poverty rates of each county at or above state average poverty rates were overlaid the food desert counties. Lastly counties were selected using a definition of "rural" based on USDA ERS 1993 urban influence code⁵ of counties not proximate to urban areas. Urban influence codes 7, 8 and 9 are those nonmetro counties that are not adjacent to metro area with a city of at least 10,000 (to

Table 1 Descriptives

	Population (2000)	Median Age (2000)	Per Capita Income (1999)	% Poverty 1999		% Age 65 Over (2000)
1. County A, MN	9,165	42.4	17,938	8.3		21.2
2. County B, MN	13,088	40.5	18,039	8.6		20.0
3. County C, IA	8,690	34.1	17,305	19.5		18.1
4. County D, IA	8,016	39.7	24,489	13.9		19.5
5. County E, IA	19,900	40.0	22,068	9.1		19.2
6. County F, IA	10,147	40.0	23,460	10.6		21.3
Iowa	2,926,324	36.6	26,431	9.9		14.9
Minnesota	4,919,479	35.4	23,198	7.9		12.1

<http://quickfacts.census.gov/qfd/states/> [Internet] Accessed May 5, 2006

⁵ The average rural county in the United States has 3.8 grocery stores. This threshold was used in defining a Midwest food desert (see Morton et al. 2005 for methodology).

50,000) residents (code 7) or not adjacent to metro area with a town of 2,500–9,999 residents (code 8) or not adjacent to metro area with towns less than 2,500 (code 9).

Table 1 summarizes the descriptive characteristics of the six study sites. County populations range between 8,000 and 20,000. Per capita incomes (1999) range from \$17,305 to \$24,489 and are lower than their respective state averages. Poverty rates are highest in Iowa which also has a higher state average poverty rate than Minnesota. Almost all the study sites have about one-fifth of their population aged 65 and older.

The Iowa random sample survey of the general population and the purposeful sample of rural users of food safety net services completed the same survey during 2002-03. Appendix A summarizes the similarities and differences in perceptions of access to food of these two samples. As expected, income differences are the most consistent significant differences with the rural users of food safety net services having lower incomes. There are few significant differences in perceptions of the food and safety net infrastructure with the exception of price of food items. The general population random samples are more likely to think local food prices are high compared to the safety net services users. In conjunction with greater resources for accessing household groceries, this belief may explain more out-of-county shopping by the general population compared to safety net service users. Safety net users are on average a little closer to their grocery store than the random sample.

Associated with lower incomes is the food insecurity issue. Food safety net users are significantly more likely to be food insecure than the general population. Analysis of Variance (ANOVA) comparing the health and well being of Iowa users of the food safety net services and the general population within each county reveal no significant differences in percent overweight, self rating of diet nutritional quality, self rating of poor health, or self-reported medical diagnosis for diabetes, CVD, hypertension or cancer (Data not shown). This suggests

that the overall health of food safety net service users and the general rural population is similar with health unrelated to differences in incomes within each county.

RESULTS

Food Access

Food access is influenced by the place-based infrastructure of how many and the location of grocery stores and the personal resources of individuals acquiring food. Our food access data include number of actual grocery stores in the county, number of minutes the respondent lives from the grocery store where they most often shop, mode of transportation to their grocery store, perceptions that there are not enough grocery stores where they live, and perceptions of high prices. Table 2 summarizes the food access patterns of Iowa and Minnesota rural users of the food safety net services and the general Iowa rural population. The food infrastructure patterns are distinctly place-based with differences between counties but similar proportions within Iowa Counties C and D between safety net and general populations agreeing that there are not enough grocery stores where they live. Minnesota safety net users report living an average of 20.3 minutes in County A and 14.5 minutes in County B from the grocery store where they most often shop. The general Iowa populations in Counties C and D report on average living greater distances (19.1 and 16.4 minutes) from the grocery store where they most often shop than the Iowa safety net population in their counties (13.8 and 15 minutes). The safety net population lives closer to the town with the grocery store (and perhaps other services such as food pantry, human services department).

In all rural sites, 26.6-44.4 percent of the population is more than 15 minutes away from the store where they report most often shopping for food. The town in Minnesota with a higher percent of the population more than 30 minutes (8.6 percent) from the store where they most often shop is also the town where almost one-third of the food safety net service users perceive

Table 2 Food access

	Rural Users of Food Safety Net Services ^a				General Rural Population ^b			
	County A, MN N=198	County B, MN N=197	County C, IA N=149	County D, IA N=121	County C, IA N=374	County D, IA N=349	County E, IA N=400	County F, IA N=393
1. Number grocery stores in county	3	2	2	2	2	2	3	4
2. Perception that there are not enough grocery stores where you live (mean) (percent)	32.0	15.0	75.2	28.9	72.5	30.2	15.3	12.2
3. How many minutes are you from the grocery store where you most often shop? (mean)	20.3	14.5	13.8	15.0	19.1	16.4	13.6	13.1
4. Percent of population more than 15 minutes from store where most often shop	39.9	38.1	26.6	37.0	44.4	37.3	30.1	32.8
5. Percent of population more than 30 minutes from store where most often shop	8.6	6.6	16.1	16.0	17.5	23.5	4.5	3.7
6. Percent use their own vehicle to get to grocery store	92.9	88.2	87.9	87.7	96.0	94.5	94.8	94.3
7. Percent depend on others to get to the grocery store	3.1	3.5	5.6	6.2	2.7	3.6	3.0	2.6
8. Perception that food prices in store where you shop are high	18.5	17.7	44.8	28.3	56.7	40.4	11.1	9.8

^a Purposeful sample of safety net services sites on specific days.

^b Random sample of general county populations (response rates range from 60.1%-64.0%).

that there are not enough grocery stores where they live. A similar pattern in Iowa shows about 16 percent of food safety net users live more than 30 minutes away from the store where they most often shop and have high perceptions of inadequate numbers of grocery stores (75.2 percent and 28.9 percent). Two Iowa general population samples with three and four stores, Counties E and F have smaller percentages (4.5 and 3.7 percent respectively) of their populations living more than 30 minutes from their grocery store and much lower rates of perceived adequacy of enough stores than counties with fewer stores. This suggests that the number of grocery stores is associated with beliefs about sufficient access to enough stores. However, a larger number of rural communities are necessary for tests of significance and causality to be conducted.

Transportation is a critical component of food access. About 94 to 96 percent of the general population use their own vehicle to get to the grocery store. However, users of the food safety net services in both Iowa and Minnesota are less likely to have their own vehicle and more often depend on others to get to the store. A higher percent of Iowa food safety net users depend on others (5.6 and 6.2 percent) than similar respondents in Minnesota (3.1 and 3.5 percent).

Perceptions about whether there are a variety of foods for purchase at good prices vary between states. A smaller portion of Minnesota food safety net users (17.7-18.5 percent) report high prices compared to Iowa's food safety net users (28.3-44.8 percent). Interestingly the general population in the same two Iowa study sites (Counties C and D) are more likely to believe prices are higher where they live than the food safety net users. This suggests that price perceptions are not associated with ability to purchase foods. A smaller portion of respondents (9.8-18.5 percent) living in counties with 3 or 4 grocery stores (County A, MN;

County E, IA; County F, IA) report high food prices compared to those with only two stores (28.3-56.7 percent).

Food Price Comparisons

Table 3 summarizes the prices of 130 items [19 spices and condiments are not included] in twelve categories and offers a comparison between Minnesota and Iowa rural stores using ANOVA. There is a great deal of food item price variation between Minnesota and Iowa study sites. The greatest number of significant ($p < .05$) price variations within categories providing nutritional value occurred in comparisons of milk and dairy products (91 percent) and canned/dried fruits (71 percent) followed by frozen juices (67 percent), frozen fruit and vegetables (57 percent), and breads and cereals (57 percent). High variations also occurred in fats and oils (67 percent), sugars and sweets (77 percent), and pre-prepared convenience foods (60 percent).

Rural Minnesota food prices in general are significantly higher than rural Iowa prices in almost all categories. Over three-quarters of all items in categories of nutritional value are higher priced in Minnesota including those in fresh fruits and vegetables, canned/dried fruits, frozen fruits and vegetables, breads and cereals, milk and dairy, and meat items categories. This contrasts with the 17.7-18.5 percent of Minnesota users of the food safety net services perceptions that food prices where they shopped are high compared to much higher proportions of Iowa users of food safety net services (28.3-44.8 percent).

A Minnesota comparison of low income urban neighborhood stores and these same rural stores reveals a significant number of foods more expensive in rural compared to urban (Hendrickson, Smith and Eikenberry 2006). Further this study found TFP market basket prices were higher than average TFP in highest poverty areas (Hendrickson et al. 2006). A rural-urban comparison of high poverty areas in Iowa reveals rural TFP prices to also be higher than urban

Table 3 Food price comparisons: Minnesota and Iowa food deserts (Minnesota N = 5; Iowa N = 11)

<u>Food Category</u>	<u>Total Number of Items</u>	<u>Number of Items Minnesota Higher Priced</u>	<u>Number of Items Iowa Higher Priced</u>	<u>(p<.05) Number of Items Significant Price Differences</u>	<u>(p<.05) Percent Total Items Significant Different Price</u>	<u>Items of Interest</u>
Fresh fruits	6	6	0	2	33	Minn **higher apples, oranges
Fresh vegetables	13	8	5	6	46	Minn**higher cabbage, carrots, onions, potatoes, squash Iowa**higher mushrooms
Canned/dried fruits	7	6	1	5	71	Minn**higher apple sauce, raisins, fruit cocktail, pears, pineapple
Canned vegetables	10	5	5	2	20	Minn**higher spaghetti sauce, whole tomatoes
Frozen juice	3	0	3	2	67	Iowa**higher apple juice, grape juice
Frozen fruit and vegetables	7	5	2	4	57	Minn**higher French fries, green peas, mixed veg Iowa**higher chopped spinach
Breads and cereals	28	21	7	16	57	Minn**higher wht bread, Fr/It bread, ham buns, dinner rolls, cornmeal, wht four, popcorn reg, Cheerios, Raisin Bran, wht rice, rolled oats,
Milk and dairy	11	8	3	10	91	Minn**higher cottage cheese, skim milk, 1%milk, 2%milk, whl milk, yogurt, evap milk, nonfat dry mik
Meat and meat alternatives	21	16	5	9	43	Minn**higher gr beef, chicken fryer, chicken thighs, ham, baked bean vegetarian, dried beans, frozen chicken, peanut butter
Fats and oils	6	6	0	4	67	Minn**higher canola oil, veg oil, mayonnaise, veg shortening
Sugars and sweets	13	11	2	10	77	Minn**higher Coke, fudgsicles, van ice cream, grape jelly, molasses, pudding snack pk, br. sugar, wht sugar, pd sugar, frozen yogurt
Pre-prepared convenience foods	5	2	3	3	60	Minn**higher tomato soup Iowa**higher hot pockets (ham & chs), macaroni & cheese

Iowa store prices collected Summer 2002, Fall 2003; Minnesota Summer 2002

Mean prices for each item by state were computed and subjected to a statistical comparison of mean differences using One Way Analysis of Variance

Table 4 Food insecurity

Table 4. Food Insecurity											
	Rural Users of Food Safety Net Services ^a				General Rural Population ^b						
	County A, MN N=198	County B, MN N=197	County C, IA N=149	County D, IA N=121	County C, IA N=374	County D, IA N=349	County E, IA N=400	County F, IA N=393	Minnesota ^c	Iowa	United States
1. Percent food secure (0-1)	65.2	46.7	74.8	71.0	85.7	88.4	89.0	91.4	92.9	90.5	89.0
2. Percent food insecure (2-6)	34.8	53.3	25.2	29.0	14.3	11.6	11.0	8.6	7.1	9.5	11.0
3. Percent food insecure with no hunger (2-4)	28.2	34.5	12.6	15.9	6.3	6.7	5.2	6.0	4.9	6.5	7.6
4. Percent food insecure with hunger (5,6)	6.6	18.8	12.6	13.1	8.0	4.9	5.8	2.6	2.2	3.0	3.4

^a Purposeful sample of rural food safety net services.

^b Random sample of general county population.

^c Nord, M., M. Andrews, S. Carlson Household Food Security in the United States 2003
<http://www.ers.usda.gov/publications/fanrr42> [Internet] Accessed December 5, 2006

sites (Morton et al. 2004). Franzini, Ribble and Spears (2001) suggest that inequality as it relates to income is often a matter of relative deprivation rather than absolute. Rural residents may be comparing local prices to regional or neighboring city markets to determine price competitiveness. Food price perceptions may be more meaningful when comparisons are made within a region or state rather than between states. This suggests that the impact of food prices is place dependent on other factors than absolute price.

Food Security

Table 4, Food Insecurity, shows that a smaller portion of the general rural population in the highest Iowa poverty counties (Counties C and D) are food secure (85.7 and 88.4 percent) than those (County E and F) at or near the state average poverty rate (89.0 and 91.4 percent). (See Morton et al. 2005 for details on multi-item index and computation of food security rates). Both Minnesota and Iowa rural users of the food safety net services are more likely to report being food insecure than the general rural population with rates ranging from 25.2-53.3 percent. Further, rates of food insecure with no hunger and food insecure with hunger are highest in the users of the food safety net services.

Social Organization of Community and Capacity to Solve Food Problems

Lastly we examine the social organization of our six study sites. Table 5 reveals that the Iowa random sample general population (51.3-79.2 percent) is more likely to perceive there are active groups in the community engaged in solving food problems than users of the food safety net in either Iowa or Minnesota (34.6-54.7 percent). The general population also perceives greater coordination efforts to meet food needs among community agencies like Food Stamps and WIC, churches and other nonprofit organizations than users of the food safety net services. Differences are particularly apparent within county comparisons (Counties C and D) of these two sample populations. This discrepancy between those who are actually experiencing food

insecurity and attempting to solve personal food access problems and the food secure population is one barrier to solving community food access problems.

Table 5 Social organization of community and capacity to solve food problems

	Rural Users of Food Safety Net Services ^a				General Rural Population ^b			
	County A, MN N=198	County B, MN N=197	County C, IA N=149	County D, IA N=121	County C, IA N=374	County D, IA N=349	County E, IA N=400	County F, IA N=393
1. My community has a number of active groups that work at solving food problems for community ^c	34.6	50.0	41.9	54.7	68.3	79.2	56.2	51.3
2. Churches in our community offer meals, food pantries, and emergency food supplies ^d	56.1	52.8	38.1	28.5	36.5	35.5	37.9	22.5
3. Government food programs like Food Stamps and WIC work together with churches and nonprofit organizations to coordinate efforts to meet food needs of people ^e	40.0	49.0	35.1	38.1	52.3	63.4	22.6	24.0
<i>Where does leadership for solving food problems in your community come from:</i>								
4. Government	47.4	52.3	68.0	75.5	73.6	74.3	66.4	69.6
5. Churches	68.4	59.4	60.5	56.5	55.5	57.5	57.1	53.6
6. Nonprofit organizations	19.9	19.3	30.5	47.1	31.4	41.5	34.3	32.8
7. Volunteer citizens	52.0	39.1	42.3	47.8	40.7	51.4	49.4	41.6
8. Local businesses	26.0	22.0	20.0	31.0	19.8	20.3	20.2	22.3

^a Purposeful sample of safety net services site on specific days.

^b Random sample of general county population.

^c Iowa: Percent respond somewhat active, quite a few active
Minnesota: Percent agree or strongly agree

^d Iowa: Percent respond often or very often
Minnesota: Percent agree or strongly agree

^e Iowa: Percent respond often or very often
Minnesota: Percent agree or strongly agree

Churches are viewed by a quarter to more than half of all participants as important community institutions engaged in offering meals, food pantries/shelves and emergency food supplies. Over 50 percent of Minnesota food safety net users report that their churches offer meals, food pantries and emergency food supplies compared to lesser portions (28.5-38.1 percent) of Iowa safety net users. Further, in the two Minnesota sites, churches are ranked first as providing leadership in solving food problems in the community followed by government or volunteer citizens compared to Iowa who ranked churches second. This seems to reflect earlier findings that food access is often based on the unique social infrastructure of each community. Food safety net users and the general population in all four Iowa sites ranked government as most often providing leadership for solving community food problems, followed by churches, volunteer citizens and nonprofit organizations. This suggests there may be state level institutional patterns that account for between state differences.

DISCUSSION

The “new” public health redirects practitioners and theorists back to an examination of structural and environmental influences on health (Campbell 1991). The opportunity structures of the local physical environment are the context in which food access and choices are made. Grocery stores are the central institution providing food access to rural populations. In this study we find that perceptions of rural food prices and problem solving strategies vary between users of food safety net services and the general population. The general population is more likely to have their own vehicle, travel more minutes to get to their regular grocery store compared to the safety net users and believe that local food store prices are higher than out-of-county ones.

Food safety net users may be choosing housing closer to rural towns in order to reduce costs to their limited resource base and more easily access the normal food system along with

other services such as food pantries/shelves and public services. Transportation concerns are central to the access of food. Food safety net users are more likely to not have their own vehicle for getting to the grocery stores and must depend on others. These findings are supported by other research (Bitto et al. 2003; Hendrickson et al. 2006). Perceptions of food prices are not consistent with actual prices suggesting that price comparisons are area specific and that the impact of food access may be dependent on other structural factors such as transportation and access to food pantries and community meals. National food price comparisons reveal that the West North Central region (where Iowa and Minnesota are located) has some of the lowest food at home expenditures (Jekanowski and Binkley 2000).

The Sobal et al. (1998) model suggests there are health outcomes from how the food system is organized. In this study we find that food safety net users are more likely to be food insecure than the general population where they live. However, an analysis of body mass index (BMI), self reported health, and selected medical diagnosis (diabetes, CVD, hypertension, and cancer) show no statistically significant differences between Iowa users of food safety net services and the random sample of the general population. There is evidence of food insecurity but no direct health impacts. Thus a relationship between health and well-being are not supported by our data. One reason for the lack of variation in health and BMI among rich and poor may be they have the same food resources to choose from and both groups eat equally poorly. This could suggest cultural and/or social norms regarding food choices are influencing health and well-being. Further, health is a cumulative outcome that requires longitudinal data to discover environmental structure relationships.

A major limitation of this study is the small number of communities analyzed and differences between Iowa and Minnesota survey instruments limiting statistical comparisons. Future studies should select thirty or more counties and multiple states so that statistical

analyses among rural places can more definitively identify whether there are health outcomes associated with the food infrastructure. This would also permit multi-level analysis to parse out local-level effects and state-level policies and institutional practices effects.

SO WHAT?

The overall well-being of a community is dependent on its infrastructure and the resources that the opportunity structure provides. Each community uniquely addresses the food access problem differently based on their perceptions and their public and private institutions. Transportation including the price of gasoline, food prices, leadership and social networks for solving food problems vary among rural communities and influence their capacity to reduce food insecurity. Access problems for the food insecure will be magnified when the general population perceives activity levels and coordination among food safety net providers that is not mirrored by the users of safety net services. This could result in less interest or willingness to adopt policies or practices that would support retaining a local grocery store, developing better rural transportation, and investing time and resources in food pantries/shelves and emergency food services.

Appendix A Differences in responses (analysis of variance) between Iowa users of safety net services and random sample of general population mail surveys

	County C, Iowa		County D, Iowa	
	Food Safety Net Users ^a N=149	General Rural Population ^b N=374	Food Safety Net Users ^a N=121	General Rural Population ^b N=349
<u>Food Access</u>				
1. There are enough supermarkets/grocery stores where I live (not enough=1; enough=2; more than enough=3)		NS		NS
2. Supermarkets/grocery stores where I live offer a variety of food for purchase at good prices (high prices=1; moderate prices=2; low prices=3)	1.59	1.44**	1.74	1.61**
3. My community has a number of active groups that work at solving food problems for community members (no active groups=1; somewhat active=2; many active=3; lots=4)		NS	2.24	1.97**
4. Churches in our community offer meals, food pantries and emergency food supplies (never=1; sometimes=2; often=3; very often=4)	2.59	2.32**		NS
5. Government food programs like food stamps and WIC work together with churches and nonprofit organizations to coordinate efforts to meet food needs of people (don't seem to work together=1; a little=2; work together=3; a lot=4)		NS		NS
6. How many minutes are you from the grocery store where you most often shop?	12.3	19.1***	15.07	16.39 NS
7. Your age	51.4	56.9**		NS
8. Your income	4.0	4.69**	3.90	5.17***
9. Education		NS	3.50	3.94**
10. Food insecure scale 0=not at all to 6=food insecure with hunger	1.0	0.65*	1.19	0.50***

^a Purposeful sample; ^b Random sample of total county population. * $p < .05$; ** $p < .01$; *** $p < .001$

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