

**MEASURING AVAILABILITY OF HEALTHFUL FOODS IN TWO RURAL  
TEXAS COUNTIES**

A Thesis

by

**BRENDA DIANE BUSTILLOS**

Submitted to the Office of Graduate Studies of  
Texas A&M University  
in partial fulfillment of the requirements for the degree of  
**MASTER OF SCIENCE**

December 2006

Major Subject: Nutrition

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**ABSTRACT**

Measuring Availability of Healthful Foods in Two Rural Texas Counties.

(December 2006)

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Chair of Advisory Committee: Dr. Joseph Sharkey

A comprehensive in-store survey may capture the availability of healthful food alternatives in different store types in two rural counties. The purpose of this study was to: (1) compare the availability of healthful foods in two rural Texas counties; and (2) compare the variety of healthful foods in two rural Texas counties. This study also acts as a pilot test for further food availability research in four other rural counties of the Brazos Valley.

An unobtrusive, observational survey was used to measure availability of healthful food in all (100%) grocery, convenience, and discount stores ( $n=44$ ) in two rural counties in the Brazos Valley of Texas. Results from the surveys indicated that availability of healthful food alternatives varied greatly among the three different store types and two counties surveyed. Grocery stores ( $n=7$ ) were more likely than convenience ( $n=31$ ) and discount ( $n=6$ ) stores to offer fresh fruits and vegetables, lean-meat options, and low-fat/skim milk products. Fresh fruits and vegetables were available in 100% of grocery stores. Only 16.1% of convenience stores, compared with 0.0% in discount stores, offered fresh fruits and vegetables. Variety of fruits and

vegetables varied greatly among the three different store types and the two counties surveyed.

Findings suggest that the survey utilized was feasible in determining the availability of healthful food items in two rural counties. Implications of this study include the need for knowledge and awareness of rural consumers and rural food supply. Furthermore, nutrition education for rural consumers and those purchasing foods provided to rural areas is desired. This study provided that further investigation into the availability of healthful foods in rural areas is needed.

## DEDICATION

To My Mother and Father...

For giving me strength to do my very best; for lighting the darkest of my days; for providing years of much needed encouragement; for supporting my dreams; and for love—infinite and unyielding. You are my counselors, my heroes, my foundation, and my two greatest fans. Thank you...and “I love YOU more.”

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## TABLE OF CONTENTS

	Page
ABSTRACT .....	iii
DEDICATION .....	v
ACKNOWLEDGMENTS.....	vi
TABLE OF CONTENTS .....	vii
LIST OF TABLES .....	viii
INTRODUCTION.....	1
Problem .....	1
Role of Environment .....	4
Dietary Guidelines for Americans 2005.....	6
Rural Environment .....	8
Significance .....	9
HYPOTHESIS AND RESEARCH QUESTIONS.....	11
Hypothesis.....	11
Research Questions .....	11
METHODS.....	12
Study Sample.....	12
Measurement .....	13
Data Collection.....	15
Statistical Analysis .....	16
RESULTS.....	17
DISCUSSION .....	25
CONCLUSION .....	30
REFERENCES .....	31
VITA .....	36

**LIST OF TABLES**

TABLE		Page
1	Availability of Fruit and Vegetables in Grocery Stores/ Supermarkets, Convenience Stores, and Discount Stores...	19
2	Availability of Meats/Fish and Eggs in Grocery Stores/ Supermarkets, Convenience Stores, and Discount Stores...	21
3	Availability of Whole Grains in Grocery Stores/ Supermarkets, Convenience Stores, and Discount Stores...	22
4	Availability of Milk/Milk Products in Grocery Stores/ Supermarkets, Convenience Stores, and Discount Stores...	23
5	Variety of Fruits and Vegetables by County and Food Store Type.....	24



## INTRODUCTION

Nutrition is a fundamental element of human life and development and it affects each individual's health across the lifespan. The manner in which nutrients become integral parts of the body and contribute to its function depends on the physiologic and biochemical processes that govern their actions (1). The inclusion of healthful foods in the diet provide an important opportunity to delay, if not prevent, the occurrence of many health disparities (2). It is widely known that nutritional, or dietary, factors contribute substantially to the burden of preventable illnesses and premature deaths in the United States (3). In fact, poor diet ranks among the leading causes of death in the United States (4).

### ***Problem***

Diet and activity patterns have been ranked second only to tobacco as the leading “actual causes of death” in the United States, i.e., contributing to the diagnosed condition associated with death (5). Indeed, dietary factors are associated with 4 of the 10 leading causes of death: coronary heart disease (CHD), some types of cancer, stroke, and type 2 diabetes (4, 6). Together, cancer, CVD, and diabetes account for about two-thirds of all deaths in the United States and about \$700 billion in<sup>1</sup> direct and indirect costs annually (7). Specific diseases and conditions linked to poor diet include cardiovascular disease (CVD), hypertension, dyslipidemia, type 2 diabetes, overweight and obesity, osteoporosis, constipation, diverticular disease, iron deficiency anemia, oral disease, and

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This thesis follows the style of *The Journal of Rural Health*.

malnutrition (8-10). A primary dietary concern is consuming too much fat, especially saturated fat, and consuming too few servings of vegetables, fruits, and grain products that are high in vitamins and minerals, carbohydrates (starch and dietary fiber), and other substances that are important to good health (2, 11). Excesses and imbalances of some food components in the diet have replaced once commonplace nutrient deficiencies with an alarming increase in the number and proportion of overweight and obese persons (11).

Overweight and obesity in the United States among children and adults have increased at an alarming rate (12). In 2002, there were more than 1 billion people overweight worldwide, with over 300 million of them obese (13). The problem of obesity and overweight is described as a new epidemic according to the Surgeon General's recent *Call to Action* (14). A high prevalence of overweight and obesity is of great public health concern because excess body fat leads to a much higher risk for premature death and for many serious disorders, including diabetes mellitus, hypertension, metabolic syndrome, dyslipidemia, CVD, stroke, gall bladder disease, respiratory dysfunction, gout, osteoarthritis, and certain kinds of cancers (8, 9, 15, 16). In 14 studies (each having more than 20,000 subjects), it has been shown that obesity is associated with an elevated risk of mortality (17). A health economist calculated that obesity is associated with a 36 percent increase in both inpatient and outpatient hospital spending—more than either the increase of costs due to smoking or drinking (18).

Obesity and overweight are clinically determined anthropometrically by use of the body mass index (BMI). BMI is determined by calculating an individual's weight

(kg) divided by their height (m<sup>2</sup>). A BMI of 25-29.9 is classified as overweight and a BMI 30 and greater classified an individual as being obese. A BMI of 19-24.9 is considered to be within a healthy weight range. When BMI was used, nearly 55 percent of the U.S. adult population was defined as overweight or obese in 1988-94, and the trend has continued to increase (19). The prevalence of obesity among adults has doubled in the past two decades (31 percent have a BMI > 30) (12).

Of substantial concern are disparities in health among racial and ethnic minorities and among different socioeconomic groups (2). Several subgroups of the population (e.g. Hispanics, American Indians, and blacks) have a strikingly high prevalence of overweight and obesity—even higher than the already high prevalence rates observed in the general population (2, 11). Several studies suggest that obesity is more prevalent among persons living in lower income households, especially among minority women (11). To address obesity concerns, the Dietary Guidelines for Americans states that there are many healthful eating patterns for healthy people that allow maximum flexibility in food choices (20). These individual dietary patterns should focus on the consumption of a variety of foods.

Concern about food choices that may have adverse effects on health is widespread in the developed world (21). People's life experiences which include ideals, personal factors, resources, social contexts, and food contexts, have major influences on food choice (20, 22). However, it has long been recognized that food availability and certain environmental factors (e.g. cultural) are dominant in food selection (21). In

many areas, regardless of location and population, food choice may or may not depend upon availability and accessibility of healthful foods.

### ***Role of Environment***

Although there is a large and growing body of research that has demonstrated the relationship of aspects of physical environment to physical activity, much about the relationship of the environment to food choice and nutritional health remains to be studied (23). The social-ecological model provides a framework for thinking about multiple levels of the environment: intrapersonal, interpersonal, institutional, community, and policy (24). This suggests that individual behaviors are influenced by other levels of the social ecology. For example, food choice may be influenced by other members of the family or by availability of certain foods within the community.

Several studies in both urban and rural areas examined community level access to food sources and found an association between limited access to grocery stores and the consumption of fewer servings of fruit, vegetables, and low-fat dairy products (25-29). Access is especially problematic for low-income, minority, or geographically-isolated individuals. Individuals residing in rural areas may be at an added disadvantage if they do not live close to a supermarket or supercenter (29, 30). Without access to the large food retailers, individuals living in rural areas are left to shop at convenience stores, gas stations, and small “mom and pop” grocers (29). *Accessibility* could be defined not only as the ease of physical access to food, but also as the access to healthful foods. Furey et al (30) define access by focusing on three components: 1) physical

access to food; 2) financial access to food; 3) access to information about food which enables consumers to make an informed choice. Food retail stores in study communities are most often assessed for the availability, and accessibility of beneficial food items (31). While access to food outlets, which provide healthful foods, prove to be a barrier for some rural consumers, the lack of availability of healthful food in those outlets may also be an additional barrier.

Availability of food is an important component of adequate nutrition within a community. To have healthful foods (foods which are conducive to good health) available is to have them present and ready for purchase and use. Much has been written to suggest that a healthy diet is more difficult, and expensive to achieve than a less healthy one and other researchers suggest that it is more difficult to access healthy, fresh food in rural towns (32). Factors that may affect availability of healthful food are accessibility, size and proximity of retail food stores, the variety and quality of foods, the availability and adequacy of public transportation systems that support food access, and the viability and sustainability of local food production and marketing infrastructures (2). Grocery stores, also known as *supermarkets*, traditionally sell a vast array of fresh and preserved foods. Sizes (as well as variety of products available) of grocery stores vary by location. Some grocery stores are “supercenters” which carry an extensive and diverse selection of food and non-food items and are often found in suburban areas (33). Convenience stores and smaller grocery/gas combinations also carry a limited selection of healthful food choices and typically offer poor selection and higher prices, compared with supermarkets and grocery stores (34). New insights into the facets of food security

(which include availability and accessibility) need to be examined in regards to rural communities (30, 35).

### ***Dietary Guidelines for Americans 2005***

The Dietary Guidelines for Americans 2005 are considered the “cornerstone of federal nutrition policy and education (36).” Because of the significance and importance of these guidelines as national standards for healthful dietary consumption, they are frequently addressed in this paper and were used as a standardized reference for the development of the study survey. The Dietary Guidelines, which are based on scientific principles, are published jointly by the U.S. Department of Agriculture (USDA) and the U.S. Department of Health and Human Services (HHS) (37). The Dietary Guidelines are periodically designed by nutrition and health experts to help healthy Americans (over two years of age) choose diets that will meet nutrient requirements, promote health, support active lives and reduce risks of chronic disease (37). The Dietary Guidelines are translated to the American public by a consumer-friendly “pyramid-shaped” illustration. The previous *Food Guide Pyramid* was replaced with the introduction of the 2005 Dietary Guidelines and a “Food Guidance System” entitled *MyPyramid.gov*. The Dietary Guidelines are the foundation of *MyPyramid.gov* which represents current nutrition and health science that can be applied to each individual’s life.

A high-quality diet that does not provide excess calories should enhance the day-to-day health, vitality, energy, and a sense of well-being among most individuals (2). The importance of variety and balance of healthful food options is one basic premise of

the Dietary Guidelines. As presented in the Guidelines (36), “nutrient-rich” foods are defined as a consumer-friendly way to describe nutrient-dense foods such as colorful fruits and vegetables, whole, fortified and fiber-rich grain foods, fat-free and low-fat dairy products, and lean meats, poultry, fish, eggs, beans and nuts. The 2005 Guidelines recommend the consumption of nutrient-dense or nutrient-rich foods while choosing foods that limit the intake of saturated and *trans* fat, cholesterol, added sugars, salt and alcohol.

The Dietary Guidelines focus on a few key points for consumers to consider when choosing foods for consumption. These key points remind individuals to consume an adequate amount of fruit and vegetables each day (total of nine servings); to choose a colorful variety of fruit and vegetables; to consume foods rich in calcium such as milk, yogurt, and cheese; to choose whole grain options at least half of the time; to select lean options of protein-rich foods; and to limit the consumption of fats, salt, and sugars. Unfortunately, in the United States, persons of all ages eat fewer than the recommended number of servings of grain products, vegetables and fruits (38).

Aside from variety and balance of healthful food, the Dietary Guidelines also recommend adequate, yet appropriate portion sizes (moderation), daily physical activity, personalization of diet, proportionality, and gradual improvement (“Steps to a Healthier You”).

### ***Rural Environment***

Rural Americans face a unique combination of factors that create disparities in health care not found in urban areas, including economic factors and cultural and social differences (28). Both under and over-nutrition are correlated with many health disparities in individuals living in rural areas and are of higher prevalence than of those living in metropolitan areas (28, 39). While overweight and obesity is found throughout the United States, the problem may be especially severe in rural areas (17).

Nutrition and overweight tied with cancer for 10<sup>th</sup> and 11<sup>th</sup> ranks among the Rural Healthy People 2010 focus areas that were rates as rural health priorities (40). There is evidence that rural life presents special challenges to maintaining a healthy weight; among these are cultural (e.g. higher dietary fat and calorie consumption and lower frequency of exercise) and structural (e.g. lack of nutrition education) limitations in rural areas that may negatively affect both diet and exercise (17). Rural areas contain fewer supermarkets and a larger proportion of smaller grocery stores compared with metro areas (27). Grocery stores in rural areas are traditionally smaller and offer a more expensive and limited selection of items (23, 41).

Traditionally, rural areas have experienced a lower incidence of overweight and obesity due to the increased physical demands characteristic of an agrarian lifestyle (17). However, this is no longer the case, and rural residents experience an increased prevalence of obesity and overweight compared to their urban counterparts (17). Published studies that assess the health priorities of rural residents are rare, however rural physicians publish concerns about rising obesity and it has been classified as a



leading health indicator by the Surgeon General, reflecting a major public health concern (14). Availability of nutrition education, including outlets for distribution of education such as access to nutrition professionals, is lacking in rural areas (42). Being said, there is evidence that rural residents comply less with dietary recommendations (43) such as the Dietary Guidelines for Americans.

### *Significance*

The retail environment is in a state of flux. More store types in both rural and urban areas (e.g., discount stores and pharmacies) are now marketing grocery items. Often, individuals residing in rural areas must purchase whatever food items are available within a small radius of their homes. Some rural stores may have a lower selection of food products in comparison with their urban counterparts (34). Little is known about the overall availability of healthful food options in rural communities. What is available in convenience stores, discount stores, and small grocery stores in rural areas may not fit the description of healthful foods. Therefore, understanding what healthful foods are available in rural areas may provide insight into the dietary patterns and food selection of rural individuals.

Much of the literature on food availability, as well as affordability and accessibility, refers to the concept of food desertification or 'food deserts.' 'Food deserts' are increasingly common in rural areas where grocery stores with healthful and affordable are several miles away and thus, inaccessible or not easily accessed (29, 30, 32). Blanchard and Lyson (29) conducted accessibility studies and indicate that many

rural areas are clearly 'food deserts.' For example, individuals living in areas with low access to large food retailers are likely to pay higher prices for groceries at small local stores or incur greater travel costs to access large food retailers (29). The creation of so-called 'food deserts' has had a considerable effect on the social geography of urban and rural areas and has led to social exclusion (32, 44). This study may stimulate further investigation into the concept of food desertification and how availability of healthful foods in rural areas may affect the rural food environment.

Using a systematic approach and comprehensive observational survey, this study investigated the availability and variety of fruit, vegetables, lean meats, low-fat dairy, and whole grains in two rural counties in Texas. The knowledge and information gained from this study can provide rural community awareness and could lead to potential community and policy interventions to improve availability of healthful foods. The purpose of this pilot study was to examine the feasibility of determining the availability of healthier food alternatives in two rural counties in the Brazos Valley of Texas.

## **HYPOTHESIS AND RESEARCH QUESTIONS**

### ***Hypothesis***

A comprehensive in-store survey can capture the availability of healthful food alternatives in different store types in two rural counties.

### ***Research Questions***

In consideration of the hypothesis, the following are research questions the author has attempted to address with this study.

- Does the availability of healthful food alternatives differ between these two rural counties?
- Does the variety of healthful food alternatives differ between these two rural counties?

## METHODS

### *Study Sample*

The Brazos Valley Food Environment Project (BVFEP) was an observational study conducted in 2005 to identify all food stores and food service places within the six rural counties of the Brazos Valley. The BVFEP used a triangulation of health department lists, on-line telephone directories, and systematic driving of roads to identify all food stores and food service places. At the time of visual identification, the exact latitude and longitude of the store was determined using Global Positioning System (GPS) technology. Additionally, an external survey of each location was conducted that identified the type of location (e.g., grocery/supermarket, convenience store, fast food restaurant, specialty food) and additional site characteristics. Using BVFEP data, the sample for this study includes all grocery/supermarkets ( $n = 7$ ), convenience stores ( $n = 31$ ), and discount stores ( $n = 6$ ) in Burleson and Madison Counties. Maps to store locations were provided by the BVFEP. The two counties chosen were the first two counties that were identified by the Brazos Valley Health Partnership as sites for Community Health Resource Centers. This identification signified the need for further rural health research in the two counties. The Brazos Valley Health Partnership is collaboration of community stakeholders that represent a variety of sectors in all seven Brazos Valley counties (6 rural and 1 urban).

According to 2005 U.S. Census population estimates (45), Madison County has an estimated population of 13,167 (28 persons per square mile) and Burleson County has 17,238 (25.9 persons per square mile). Demographics show that female persons make

up 51.5% of Burleson County and 41.3% of Madison County; race/ethnic minorities comprise 16.4% of Burleson County and 23.3% of Madison County.

Grocery, discount, and convenience stores were all defined using North American Industry Classification System (NAICS) definitions (46). Grocery stores were defined as being primarily engaged in retailing a general line of food, such as canned and frozen foods; fresh fruits and vegetables; and fresh and prepared meats, fish, and poultry. Discount stores, under the NAICS classification of “All Other General Merchandise Stores,” were defined as establishments which retail a general line of new merchandise, such as apparel, automotive parts, dry goods, hardware, groceries, housewares or home furnishings, and other lines in limited amounts, with none of the lines predominating. Convenience stores were defined as being primarily engaged in retailing a limited line of good that generally includes milk, bread, soda, and snacks.

### ***Measurement***

*Store Characteristics.* Data were collected on various store characteristics and included hours of operation, building exterior and parking lot conditions, availability of shopping carts, quality of interior lighting, store interior conditions, number of checkout stands, and other services offered (e.g. customer service, photo processing). These data may be helpful in determining the rural food environment as it relates to aesthetic characteristics of food outlets. For example, studies have determined that greater neighborhood safety and attractiveness (e.g. no excess litter, vandalism) can reduce exposure to violence (47, 48).

*Food Availability.* Based on the literature, the 2005 Dietary Guidelines for Americans (37), the work of the researchers in the Lower Mississippi Delta (49), and input from several local Registered Dietitians, a survey instrument was developed that used an observational assessment approach of the store environment by a trained surveyor. Food categories included fruit, vegetables, meat/fish/eggs, milk/milk products, oils, and grains. For fruit and vegetables, data were separately collected for fresh, canned, and frozen. For canned fruits, healthful options were those that were either packaged in their own juice or in light syrup. With meats, data were collected on fresh, frozen, canned, and processed beef, poultry, and fish. Healthful meat choices include low-fat options and lean cuts. Healthful grain options were defined as those with 100% whole wheat or whole grain as the first ingredient; along with brown rice and no sugar added oatmeal and cereal. Milk/milk products were defined as healthful if they were low/reduced fat items or low-fat/skim milk.

Food items were identified as being available or not available. This paper reports on the following food types: fruit, vegetables, whole grains, meat/fish/eggs, and milk/milk products. All in-store food surveys were conducted within a 30 day period (August – September 2006), therefore seasonal variation of foods among stores was not considered to be an issue.

*Food Variety.* Food variety included the number of different items within a category. For example, data were collected on the number of different fruits and the number of different types of individual fruit. Variety was considered in the development

of the study survey due to the importance of food variety and balance as reflected in the Dietary Guidelines for Americans 2005.

### ***Data Collection***

Data were collected from all stores approached through a structured observational survey; no stores refused to participate. The instrument was pre-tested in a variety of store types in an urban county that was not part of the study sample. The pre-tests were conducted in six grocery stores, eleven convenience stores, and three discount stores. Three methods of data collection were tested as part of the overall pre-test: 1) tablet PC with survey software, 2) digital voice recorder, and 3) paper-and-pencil hard copy. Due to limitations of the tablet PC for data collection (battery time, weight of tablet PC, survey software) and digital recording (store background noise and music), a seven page paper-and-pencil survey was found to be easier to use, more accurate, and less time consuming. The survey instrument and observational protocol were modified based on the pre-test.

A week prior to data collection in the two rural counties, a personalized letter was sent to the manager/owner of each of the food stores and food service places surveyed. The letter introduced the project, requested permission to survey the respective store, and mentioned that the surveyor would identify herself upon entering the store and ask permission to complete the survey of the store. The surveyor reaffirmed that the survey was observational; store customers would not be interviewed; and the survey would in no way interfere with the store's regular service to their customers. Data

collection involved traveling through the 666 square miles of Burleson County and 470 square miles of Madison County. Between the two counties surveyed, approximately 652 miles were logged during data collection (~320 miles in Madison; ~332 in Burleson) Data were entered from hard copy into a relational database. Food stores were identified using the Store ID that was assigned by the BVFEP.

### *Statistical Analysis*

Store characteristics and frequency of individual fruit, vegetable, meat/fish/egg, whole grains, and milk/milk product food items were calculated by store type for the 44 food stores in this pilot study. Means and standard deviations for variety of fruits and vegetables were calculated. Availability and variety of items were compared among store types and between the two counties. Statistical analyses were performed using Stata 8 (50).



## RESULTS

General store characteristics were recorded for all stores in the study sample. All 44 grocery, convenience, and discount stores in the two counties were surveyed, which included 7 grocery stores (Burleson county  $n=5$ , Madison county  $n=2$ ), 31 convenience stores (Burleson county  $n=19$ , Madison county  $n=12$ ), and 6 discount stores (Burleson county  $n=3$ , Madison county  $n=3$ ). General store characteristics revealed that 8 stores were open for 24 hours each day of the week. Nine of the stores in the sample had trash around the exterior of the building, whereas 13 stores had visible trash in the parking lot. One store had evidence of both exterior and parking lot trash as well as signs of vandalism. Of the 44 stores surveyed, 23 were in need of parking lot repair. A total of 14 stores provided shopping carts (grocery  $n=6$ ; convenience  $n=2$ ; discount  $n=6$ ). The quality of interior lighting of all the stores surveyed was classified as “good” with the exception of 12 stores (grocery  $n=1$ ; convenience  $n=11$ ) with “fair” lighting and 1 store (grocery  $n=1$ ) with “poor” lighting. Floor and aisle trash were present within 6 of the stores surveyed (grocery  $n=2$ ; convenience  $n=1$ ; discount  $n=3$ ). Barriers (e.g. boxes, crates) on the floor and in aisles were present in 16 of the stores surveyed (grocery  $n=6$ ; convenience  $n=5$ ; discount  $n=5$ ). The number of checkout stands was also documented and ranged from 1-6 stands in grocery, 1-2 stands in convenience, and 2-6 stands in discount stores. Other services offered by the stores surveyed include (but are not limited to): customer service centers ( $n= 8$ ; grocery  $n=5$ , convenience  $n=1$ , discount  $n=2$ ); bill pay ( $n= 2$ ; convenience  $n=2$ ); floral department ( $n=1$ ; grocery  $n=1$ ); pharmacy ( $n= 5$ ; grocery  $n=3$ , discount  $n=2$ ); bakery ( $n=2$ ; grocery  $n=2$ ); and delicatessen ( $n= 7$ ;

grocery  $n=3$ , convenience  $n=4$ ). Of the 44 stores surveyed, 27 (grocery  $n=7$ ; convenience  $n=18$ ; discount  $n=2$ ) offered additional services which include photo processing, café, check cashing, meat market, national and international money transfer, and video rental. As a result of the Brazos Valley Food Environment Project (BVFEP), additional characteristics of the food stores surveyed were documented. The grocery stores in the two counties surveyed were categorized as being either *chain* or *local* (independent) operations; three stores were classified as being *chain* stores and four were *local*. Grocery store sizes varied with only one classified as *very large*; three were *large*; two were *medium*; and one was *small*. Of the seven total grocery stores surveyed, only two of them were grocery/gas combinations. Convenience stores were examined for having a “food mart” or “grocery” label and/or signage. Of the 31 convenience stores surveyed, only four identified themselves to be “food marts” or stores which carried grocery items.

Summary statistics for fruit and vegetable availability are shown in Table 1. Based on the presence of any of nine specific fruits, all 7 grocery stores marketed fresh fruit, 3 of the 31 convenience stores, and none of the discount stores. Fresh vegetables were available in all grocery stores and in 16.1% ( $n = 5$ ) of convenience stores. More than 77% ( $n = 24$ ) of convenience stores offered canned fruit, 18 convenience stores marketed a more healthful alternative (e.g. own juice or lite syrup). Canned vegetables were available in almost all stores (100% of grocery stores, 90.3% of convenience stores, and 100% of discount stores).

**Table 1. Availability of Fruit and Vegetables in Grocery Stores/Supermarkets, Convenience Stores, and Discount Stores**

	Grocery (n=7)	Convenience (n=31)	Discount (n=6)
<b>Fruit</b>			
Fresh	100 (7)	16.1 (5)	0
Apples	100 (7)	12.5 (1)	0(0)
Bananas	85.7 (6)	6.4 (2)	0 (0)
Berries	57.1 (4)	0 (0)	0 (0)
Grapes	85.7 (6)	0 (0)	0 (0)
Mango	28.6 (2)	0 (0)	0 (0)
Melon	85.7 (6)	0 (0)	0 (0)
Oranges	100 (7)	3.2 (1)	0 (0)
Peaches	57.1 (4)	0 (0)	0 (0)
Pears	57.1 (4)	0 (0)	0 (0)
Canned	100 (7)	77.4 (24)	100 (6)
Own juice	100 (7)	51.6 (16)	83.3 (5)
Lite syrup	100 (7)	48.4 (15)	66.7 (4)
Own juice or lite syrup	100 (7)	58.1 (18)	100 (6)
Frozen	71.4 (5)	6.4 (2)	0 (0)
Fruit juice	100 (7)	93.5 (29)	100 (6)
100% fruit juice	100 (7)	90.3 (28)	100 (6)
<b>Vegetables</b>			
Fresh	100 (7)	16.1 (5)	0 (0)
Avocado	100 (7)	0 (0)	0 (0)
Carrots	100 (7)	3.2 (1)	0 (0)
Corn	57.1 (4)	0 (0)	0 (0)
Cruciferous	57.1 (4)	0 (0)	0 (0)
Green beans	42.9 (3)	0 (0)	0 (0)
Greens	57.1 (4)	0 (0)	0 (0)
Lettuce	100 (7)	12.9 (4)	0 (0)
Okra	14.3 (1)	0 (0)	0 (0)
Onions	85.7 (6)	12.9 (4)	0 (0)
Potatoes	100 (7)	12.9 (4)	0 (0)
Squash	57.1 (4)	0 (0)	0 (0)
Tomatoes	100 (7)	16.1 (5)	0 (0)
Canned	100 (7)	90.3 (28)	100 (6)
Beans/legumes	100 (7)	58.1 (18)	83.3 (5)
Beets	100 (7)	12.9 (4)	33.3 (2)

**Table 1 (continued)**

	Grocery (n=7)	Convenience (n=31)	Discount (n=6)
Carrots	100 (7)	32.3 (10)	83.3 (5)
Corn	100 (7)	74.2 (23)	50 (3)
Green beans	100 (7)	80.6 (25)	50 (3)
Greens	100 (7)	38.7 (12)	50 (3)
Mixed vegetables	85.7 (6)	35.5 (11)	50 (3)
Okra	14.3 (1)	6.4 (2)	0 (0)
Peas	100 (7)	64.5 (20)	50 (3)
Potatoes	100 (7)	48.4 (15)	50 (3)
Tomatoes	100 (7)	80.6 (25)	83.3 (5)
Frozen	100 (7)	16.1 (5)	66.7 (4)
Beans/legumes	71.4 (5)	0 (0)	0 (0)
Corn	100 (7)	3.2 (1)	0 (0)
Cruciferous	100 (7)	6.4 (2)	0 (0)
Green beans	85.7 (6)	0 (0)	0 (0)
Greens	85.7 (6)	6.4 (2)	0 (0)
Mixed vegetables	100 (7)	6.4 (2)	0 (0)
Peas	100 (7)	0 (0)	0 (0)
Potatoes	100 (7)	12.9 (4)	66.7 (4)
Vegetable juice	100 (7)	77.4 (24)	66.7 (4)
100% vegetable juice	100 (7)	77.4 (24)	33.3 (2)

Table 2 presents summary statistics for the availability of meats/fish and eggs by store type. Healthier fresh meat options were of greater availability in grocery stores, compared with discount stores which offered no healthful options. None of the 44 stores surveyed offered healthful frozen meat options. Grocery stores had a wider variety of lean processed meat options when compared to convenience and discount stores which only offered lean beef/ham. Eggs were available at all (100%) grocery and discount stores and available in only 61.3% of convenience stores. Egg substitute was not

available in convenience and discount stores and only 42.9% of grocery stores carried that option.

**Table 2. Availability of Meats/Fish and Eggs in Grocery Stores/Supermarkets, Convenience Stores, and Discount Stores**

	Grocery (n=7)	Convenience (n=31)	Discount (n=6)
<b>Meat/Fish</b>			
Fresh	100 (7)	9.7 (3)	0 (0)
Lean ground beef	85.7 (6)	0 (0)	0 (0)
Extra lean ground beef	14.3 (1)	0 (0)	0 (0)
Lean ground poultry	28.6 (2)	0 (0)	0 (0)
Finfish	42.9 (3)	0 (0)	0 (0)
Frozen	100 (7)	9.7 (3)	50 (3)
Lean ground beef	0 (0)	0 (0)	0 (0)
Extra lean ground beef	0 (0)	0 (0)	0 (0)
Lean ground poultry	0 (0)	0 (0)	0 (0)
Finfish	85.7 (6)	0 (0)	0 (0)
Canned	100 (7)	93.5 (29)	100 (6)
Tuna/salmon (water pack or vacuum pack)	100 (7)	74.2 (23)	100 (6)
Sardines	100 (7)	77.4 (24)	66.7 (4)
Poultry (chicken/turkey)	100 (7)	12.9 (4)	83.3 (5)
Processed	100 (7)	67.7 (21)	66.7 (4)
Lean beef/ham	71.4 (5)	35.5 (11)	33.3 (2)
Lean bologna	57.1 (4)	0 (0)	0 (0)
Lean hot dogs	57.1 (4)	0 (0)	0 (0)
Lean chorizo	0 (0)	0 (0)	0 (0)
Lean bacon	57.1 (4)	0 (0)	0 (0)
Lean sausage	28.6 (2)	0 (0)	0 (0)
Eggs	100 (7)	61.3 (19)	100 (6)
Whole eggs	100 (7)	61.3 (19)	100 (6)
Egg substitute	42.9 (3)	0 (0)	0 (0)

The availability of whole grains in the study sample is shown in Table 3. One hundred percent whole wheat options for tortillas, rolls/buns, and bagels/English muffins could only be found in grocery stores. Whole wheat/grain options of ready-to-eat cereals were found in all (100%) grocery and discount stores, but were only available in over half (51.6%) of all convenience stores. All (100%) discount stores carried 100% whole wheat bread in comparison with 85.7% of grocery stores and 41.9% of convenience stores with the same option.

**Table 3. Availability of Whole Grains in Grocery Stores/Supermarkets, Convenience Stores, and Discount Stores**

	Grocery (n=7) % (n)	Convenience (n=31) % (n)	Discount (n=6) % (n)
Tortillas	100 (7)	45.2 (14)	83.3 (5)
Whole wheat	57.1 (4)	0 (0)	0 (0)
Low fat (not whole wheat)	57.1 (4)	41.9 (13)	66.7 (4)
Ready-to-Eat Cereal	100 (7)	71.0 (22)	100 (6)
Corn flakes	100 (7)	45.2 (14)	50 (3)
Whole wheat	100 (7)	51.6 (16)	100 (6)
Cooked Cereal (no sugar)	100 (7)	38.7 (12)	33.3 (2)
Oatmeal	100 (7)	32.3 (10)	33.3 (2)
Grits/cream of wheat	100 (7)	12.9 (4)	0 (0)
Breads	100 (7)	83.9 (26)	100 (6)
Wheat	85.7 (6)	58.1 (18)	100 (6)
100% whole wheat	85.7 (6)	41.9 (13)	100 (6)
Rolls/Buns/Bagels	100 (7)	67.7 (21)	83.3 (5)
White rolls/buns	100 (7)	64.5 (20)	83.3 (5)
Wheat rolls/buns	14.3 (1)	0 (0)	0 (0)
100% whole wheat rolls/buns	42.9 (3)	0 (0)	0 (0)
Whole wheat bagel/English muffin	28.6 (2)	0 (0)	0 (0)
Rice/Pasta	100 (7)	80.6 (25)	100 (6)
Brown rice	57.1 (4)	3.2 (1)	0 (0)
Whole wheat pasta	14.3 (1)	3.2 (1)	0 (0)

Availability of milk/milk products surveyed in the study sample is represented in Table 4. The more healthful milk option, which is skim (fat-free)/1% (low-fat), was available in all (100%) grocery stores, 22.6% of convenience stores, and 83.3% of discount stores. Low-fat/fat-free yogurt was mostly available in grocery stores (71.4%). Low-fat cheese options were not frequently available in convenience and discount stores.

**Table 4. Availability of Milk/Milk Products in Grocery Stores/Supermarkets, Convenience Stores, and Discount Stores**

	Grocery (n=7)	Convenience (n=31)	Discount (n=6)
Milk	100 (7)	93.5 (29)	100 (6)
Skim/low fat	100 (7)	22.6 (7)	83.3 (5)
Reduced fat	100 (7)	74.2 (23)	100 (6)
Low fat powdered	71.4 (5)	9.7 (3)	0 (0)
Yogurt	71.4 (5)	9.7 (3)	0 (0)
Low fat/fat free	71.4 (5)	9.7 (3)	0 (0)
Low fat/ fat free with fruit	71.4 (5)	9.7 (3)	0 (0)
Cheese	100 (7)	67.7 (21)	100 (6)
Low fat hard cheese	28.6 (2)	0 (0)	0 (0)
Low fat soft cheese	100(7)	19.3 (6)	33.3 (2)
Low fat processed cheese	57.1 (4)	0 (0)	0 (0)

Variety was shown by the total number of different food products within a category. Table 5 shows the mean  $\pm$  standard deviation scores for the variety of fruits and vegetables (fresh, canned, frozen, and 100% juice) by store type and county. The variety of fresh fruit in Burlinson county grocery stores ( $5.8 \pm 1.9$ ) was less than grocery

stores in Madison county ( $8.5 \pm 0.7$ ). Measurement of fresh vegetable variety shows comparable results when evaluating counties; Burleson county grocery stores ( $8 \pm 2.7$ ) compared with Madison county grocery stores ( $10.5 \pm 0.7$ ). Fresh fruits and vegetables were not found in discount stores and were seldom found in convenience stores in both counties. The table also shows store and county differences in the variety of canned fruits and vegetables.

**Table 5. Variety of Fruits and Vegetables by County and Food Store Type**

	Burleson			Madison		
	Grocery	Convenience	Discount	Grocery	Convenience	Discount
<b>Fruit</b>						
Fresh	$5.8 \pm 1.9$	$0.05 \pm 0.23$	0	$8.5 \pm 0.7$	$0.25 \pm 0.6$	0
Canned						
Own juice	$8.6 \pm 6.5$	$1.7 \pm 2.0$	$2.3 \pm 1.1$	$17 \pm 0$	$1.1 \pm 1.8$	$1.3 \pm 1.5$
Lite syrup	$12.2 \pm 10.4$	$1.3 \pm 1.6$	$4.7 \pm 4.2$	$29.5 \pm 14.8$	$0.9 \pm 1.6$	$6 \pm 5.3$
Frozen	$5 \pm 5.2$	0	0	$7 \pm 9.9$	$0.25 \pm 0.6$	0
100% fruit juice	$24.6 \pm 21.8$	$5.1 \pm 3.1$	$10.3 \pm 2.3$	$39 \pm 4.2$	$4 \pm 2.8$	$6 \pm 3.6$
<b>Vegetables</b>						
Fresh	$8 \pm 2.7$	$0.6 \pm 1.4$	0	$10.5 \pm 0.7$	$0.6 \pm 1.4$	0
Canned	$10 \pm 0.7$	$6 \pm 2.8$	$7.7 \pm 4.0$	$10 \pm 0$	$4.2 \pm 4.1$	$4 \pm 4.6$
Frozen	$7.2 \pm 1.1$	$0.1 \pm 0.32$	$0.67 \pm 0.6$	$8 \pm 0$	$0.75 \pm 1.8$	$0.67 \pm 0.6$
100% vegetable juice	$6.4 \pm 3.0$	$1.8 \pm 1.3$	$0.67 \pm 1.1$	$11 \pm 4.2$	$2.1 \pm 1.2$	$0.33 \pm 0.6$



## DISCUSSION

The hypothesis that a comprehensive in-store survey can capture the availability of healthful food alternatives in two rural counties is supported by these data. Other studies using food availability surveys have determined that more healthful food is less available in areas of low-income and/or distance from urban grocery stores/supermarkets (23, 27, 30, 34, 41, 49, 51). Much of the existing literature includes examinations into affordability and/or accessibility of foods as well as availability of foods in low-income urban areas with few studies focusing specifically on rural availability of healthful foods. Furthermore, previous studies did not include all three store types (grocery, convenience, and discount) as a source of food items.

In the two counties surveyed, a limited number of grocery stores existed ( $n=7$ ). A majority of the grocery stores carried more healthful food alternatives; however some foods were of limited amounts and selection. Convenience and discount stores were found to be less likely to offer healthful options; specifically fresh fruit and vegetables, lean meats, 100% whole wheat products (not including ready-to-eat cereal and bread), and low-fat yogurt and cheese. Consistent with the Dietary Guidelines for Americans 2005 recommendations to consume a variety of fresh fruits and vegetables, fruit and vegetable variety was examined. Fruit and vegetables whether fresh, canned, frozen, or 100% juice were less available in convenience and discount stores than in grocery stores for both counties.

Food accessibility, availability, and choice are inextricably linked (32). The issue of availability incorporates the notions of physical access and affordability to food.

Rural consumers can only purchase what is available and accessible to them, so despite one's level of nutritional knowledge and/or income, food choice ultimately relies upon food availability. "Food selection" is more important than "food choice" since the lower income consumer can only choose from what is available to him/her in the store that is accessible to him/her (32). However, individuals may choose to eat less healthful foods despite the fact that healthful food alternatives are available. For the low-income individuals, less healthful food alternatives are often more affordable than more healthful options (26, 30). This discussion brings to mind an important question about the nutritional health of rural individuals. Are rural health disparities, as a result of poor nutrition, caused by lack of accessibility and availability of healthful food alternatives, or are they caused by poor food choice?

Food purchases and food choice may not be reflected by taste or food preference alone. For many low-income individuals, food purchases may rely upon the adequacy of their home food storage/preparation appliances. Individuals without adequate refrigeration may rely upon the availability of non-perishable items such as powdered milk and eggs and canned meats. Those with a microwave oven and no range oven or stove may be forced to consume mostly microwaveable meals or foods that can be easily prepared in a microwave. To the author's knowledge, little is known about the adequacy of home food storage/preparation appliances in rural areas. As discussed, lack of adequate food storage/preparation appliances may greatly affect which foods are purchased for consumption. Future studies may examine this issue in depth to determine

“actual causes” of food choices/purchases as they are reflected by adequacy of home food preparation appliances as well as food preparation knowledge of rural individuals.

Considering that this is a pilot study, there were a number of limitations observed. First, this study examined a small amount of food stores ( $n=44$ ), despite the fact that 100% of the grocery, convenience, and discount stores in the two counties were surveyed. The small sample number restricted the ability to consider a variety of statistical methods. Secondly, availability alone was measured; accessibility and affordability were not considered in data collection. When factoring in accessibility and affordability along with availability of healthful foods, a greater understanding of the determinants of rural nutritional health would result. It has been determined that, despite variances in availability from one county to the other, the two counties surveyed and the establishments/ institutions within were diverse; data were not available to consider other explanations for observed county differences (e.g., age, income, race/ethnicity of residents), differences in purchasing preferences of local store owners, and differences in food preference of consumers.

Implications of this study include the need for knowledge and awareness of rural consumers and rural food supply. Independent store owners/managers who are responsible for food purchasing can have a great impact on what is available within their stores. Store owners/managers with nutrition knowledge/awareness may be more likely to provided healthful options to the population they serve. Nutrition education provided to rural consumers and independent food store owners/managers may help significantly to influence the purchase and consumption of more healthful food alternatives. Nutrition

education policies and programs could be provided through community empowerment initiatives and collaborations with regional (local) health and wellness agencies.

Nutrition education programs could help to educate both consumers and business leaders which, in turn, could have a positive impact on the rural nutrition environment.

Development of future strategies to change nutrition environments with nutrition education is needed. Initiation of public policies, which may improve the economic viability of rural communities, is also needed to increase the availability of healthful food products to supply an adequate diet and the “further development of policies which will ensure adequate retail provision of foods to those who are disadvantaged (52).”

Rural areas also tend to lack public transportation services and large food retailers are fewer, resulting in greater travel distances (27). Collaborations with local food store owners, health agencies, and transportation companies may result in the development of programs which provide transportation (for those who experience accessibility difficulties) to and from food stores with greater food availability. Development of creative and flexible designs for transportation services and the coordination of transport resources in rural communities are needed. Previous nutritional health initiatives have been successful in North America and Scotland and include food co-operatives, community-supported agriculture programs, farmers markets, community cafes, school-based breakfast clubs and supermarket-funded courtesy buses running from peripheral housing estates to large food stores (53, 54).

Determining the availability of healthful food in grocery, convenience, and discount stores in rural areas has provided insight into potential dietary choices made by

rural consumers based on selection. Understanding what healthful foods are available could lead to a solution which may improve the overall food supply for rural consumers. Future studies may address public policy options and community programs which may enhance the opportunity for healthful foods to be available to rural consumers.

## CONCLUSION

The purpose of this study was to examine the feasibility of determining the availability of healthful food alternatives in two rural counties in the Brazos Valley of Texas. This study determined that further investigation into the availability of healthful foods in rural areas is needed. This study also acts as a pilot test for food availability research in four other rural counties of the Brazos Valley. In the near future, food availability data will be collected for each grocery store/supermarket, convenience store, and discount store in the remaining counties using the survey instrument utilized in this study. Results of this study, and comparable studies in the future, could be used to enable change in public policy, community empowerment, and collaborations with regional (local) agencies to enhance nutrition education and availability of healthful food in rural areas.

## REFERENCES

1. Mahan LK, Escot-Stump S, eds. *Krause's Food, Nutrition, & Diet Therapy*. 10th ed. Philadelphia: W.B. Saunders Company; 2000. 4.
2. US Department of Agriculture, US Department of Health and Human Services. Dietary Guidelines for Americans Committee report. Washington, DC: USDA, DHH; 2005. Available at: [http://www.health.gov/dietaryguidelines/dga2005/report/HTML/B\\_Introduction.htm](http://www.health.gov/dietaryguidelines/dga2005/report/HTML/B_Introduction.htm). Accessed September 29, 2006.
3. Frazao E, ed. *The High Costs of Poor Eating Patterns in the United States*. America's eating habits; changes and consequences. Washington, DC: US Department of Agriculture (USDA), Economic Research Service (ERS); 1999. Document no. AIB-750.
4. Mokdad AH, Marks JS, Stroup DF, Gerberding JL. Actual causes of death in the United States, 2000. *Journal of the American Medical Association*. 2004;**291**:1238-1245.
5. McGinnis JM, Foege WH. Actual causes of death in the United States. *Journal of the American Medical Association*. 1993;**270**:2207-2212.
6. National Center for Health Statistics. *Report of final mortality statistics, 1995*. Monthly Vital Statistics Report. June 12, 1997;**45**(11):Supp. 2.
7. Eyre H, Khan R, Robertson RM, Clark NG, Doyle C, Hong Y, Gansler T, Glynn T, Smith RA, Taubert K, Thun MJ. Preventing Cancer, Cardiovascular Disease, and Diabetes. A Common Agenda for the American Cancer Society, the American Diabetes Association, and the American Heart Association. *Cancer Journal for Clinicians*. 2004;**54**:190-207.
8. US Department of Health and Human Services. *Physical Activity and Health: A Report of the Surgeon General*. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. National Center for Disease Prevention and Health Promotion; 1996.
9. US Preventive Services Task Force. *Guide to Clinical Preventive Services*. 2nd ed; Rockville, MD: Agency for Healthcare Research and Quality; 1996.
10. Kant A. Dietary patterns and health outcomes. *Journal of the American Dietetic Association*. 2004;**104**(4):615-635.

11. Food and Drug Administration. *Healthy People 2010: Objectives for Improving Health*. Food and Drug Administration (FDA), National Institutes of Health (NIH); 2000. 19.2-19.54.
12. Flegal KM, Carroll MD, Ogden CL, Johnson CL. Prevalence and trends in obesity among US adults, 1999-2000. *Journal of the American Medical Association*. 2002;**288**:1723-1727.
13. Bazzano L. The high cost of not consuming fruits and vegetables. *Journal of the American Dietetic Association*. 2006;**106**(9):1364-1368.
14. Satcher D. *The Surgeon General's Call to Action to Prevent and Decrease Overweight and Obesity 2001*. Washington, DC: US Department of Health and Human Services; 2001.
15. National Institute of Health, National Heart, Lung, and Blood Institute. *Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults*. Bethesda, MD: Department of Health and Human Services, Public Health Service; 1998. 29-41.
16. Pi-Sunyer X. Medical hazards of obesity. *Annals of Internal Medicine*. 1993;**119**:655-660.
17. Tai-Seale T, Chandler C. *Nutrition and Overweight Concerns in Rural Areas: A Literature Review*. Rural Healthy People 2010: A companion document to Healthy People 2010. College Station, TX: The Texas A&M University System Health Science Center, School of Rural Public Health, Southwest Rural Health Research Center; 2003. 1-16.
18. Sturm R. The effects of obesity, smoking, and drinking on medical problems and costs. Obesity outranks both smoking and drinking in its deleterious effects on health and health costs. *Health Affairs (Millwood)*. 2002;**21**(2):245-253.
19. World Health Organization. *Obesity: Preventing and Managing the Global Epidemic*. Report of a WHO Consultation on Obesity, Geneva, 3-5 June 1997. Geneva, Switzerland; 1998 June.
20. American Dietetic Association. *Total Diet Approach to Communicating Food and Nutrition Information*. Position Paper. Chicago, IL: 2002; 1-18.
21. Steptoe A, Pollard T. Development of a measure of the motives underlying the selection of food: the Food Choice Questionnaire. *Appetite*. 1995;**25**:267-284.



22. Furst T, Connors M, Bisogni CA, Sobal J, Falk LW. Food Choice: A conceptual model of the process. *Appetite*. 1996;**26**(3):247-266.
23. Glanz K, Sallis J, Saelens B, Lawrence FD. Healthy nutrition environments: Concepts and measures. *American Journal of Health Promotion*. 2005;**19**(5):330-333.
24. McLeroy K, Bibeau D, Steckler A, Glanz K. An ecological perspective on health promotion programs. *Health Education Quarterly*. 1988;**15**(4):351-378.
25. Kaufman P, MacDonald J, Lutz S, Smallwood D. *Do the Poor Pay More for Food? Item Selection and Price Differences Affect Low-Income Household Food Costs*. Agricultural Economic Report. Washington, DC: USDA; 1997 November. Report No. 759.
26. Drewnowski A, Barratt-Fornell A. Do healthier diets cost more? *Nutrition Today*. 2004;**39**(4):161-168.
27. Kaufman P. Rural poor have less access to supermarkets, large grocery stores. *Rural Development Perspectives*. 1999;**13**(3):19-26.
28. Stuff J, Casey PH, Szeto KL, Gossett JM, Robbins JM, Simpson PM, Connell C, Bogle ML. Household food insecurity is associated with adult health status. *Journal of Nutrition*. 2004;**134**:2330-2335.
29. Blanchard T, Lyson T. Access to Low Cost Groceries in Nonmetropolitan Counties: Large Retailers and the Creation of Food Deserts. 2002:1-24. Available at: <http://lsrdc.msstate.edu/measuring/blanchard.pdf>. Accessed July 6, 2006.
30. Furey S, Farley H, Strugnell C. An investigation into the availability and economic accessibility of food items in rural and urban areas of Northern Ireland. *International Journal of Consumer Sciences*. 2002;**26**(4):313-321.
31. Hosler A. Environmental Assessment Project. University at Albany Prevention Research Center; 2003. Available at: [http://www.albany.edu/sph/prc\\_new/envass\\_project.htm](http://www.albany.edu/sph/prc_new/envass_project.htm). Accessed August 19, 2006.
32. Furey S, Strugnell C, McIlveen H. An investigation of the potential existence of "food deserts" in rural and urban areas of Northern Ireland. *Agriculture and Human Values*. 2001;**18**:447-457.

33. Andrews M, Kantor L, Lino M, Ripplinger, D. Using USDA's Thrifty Food Plan to assess food availability and affordability. *Food Review*. 2001;**24**(2):45-53.
34. Kantor L. Community food security programs improve food access. *Food Review*. 2001;**24**(1):20-26.
35. Nathoo T, Shoveller J. Do healthy food baskets assess food security? Chronic Diseases in Canada: 2003. 1-9. Available at: [http://www.phac-aspc.gc.ca/publicat/cdic-mcc/24-2/c\\_e.html](http://www.phac-aspc.gc.ca/publicat/cdic-mcc/24-2/c_e.html). Accessed July 17, 2006.
36. Department of Health and Human Services, US Department of Agriculture. Dietary Guidelines for Americans 2005. Available at: <http://www.health.gov/dietaryguidelines/dga2005/document/>. Accessed September 23, 2006.
37. Department of Health and Human Services, US Department of Agriculture. Dietary Guidelines for Americans 2005. Available at: <http://www.health.gov/dietaryguidelines/dga2005/document/html/brochure.htm>. Accessed September 9, 2006.
38. Crane N, Hubbard VS, Lewis CJ. National nutrition objectives and the dietary guidelines for Americans. *Nutrition Today*. 1998;**33**:49-58.
39. Wilhide S. *Rural Health Disparities and Access to Care; A report*. Kansas City, MO: National Rural Health Association; March 20, 2002. 1-4.
40. Gamm L, Hutchison L, Bellamy G. Rural healthy people 2010: Identifying rural health priorities and models for practice. *Journal of Rural Health*. 2002;**18**(1):9-14.
41. Donkin A, Dowler E, Stevenson S, Turner S. Mapping access to food in a deprived area: The development of price and availability indices. *Public Health Nutrition*. 2000;**3**(1):31-38.
42. Leeper JH, Hullet S, Wang, L. Rural Alabama health professional training consortium: Six-year evaluation results. *Family and Community Health*. 2001;**24**(2):18-26.
43. Johnson R, Johnson DG, Wang MQ. Characterizing nutrient intakes of adolescents by sociodemographic factors. *Journal of Adolescent Health*. 1994;**15**(2):149-154.

44. Beaumont J, Leather S, Lang T, Mucklow C. *Nutrition Task Force: Low Income Project Team Working Group 2 Policy; a report*. London: Institute of Grocery Distribution; 1995.
45. US Census Bureau. Washington D.C.; 2006. Available at: <http://www.census.gov/>. Accessed October 13, 2006.
46. ECPC, OMG, INEGI. 2002 North American Industry Classification System (NAICS) Definitions. Washington, D.C.: U.S. Census Bureau; 2006. Available at: <http://www.census.gov/epcd/www/naics.html>. Accessed October 5, 2006.
47. Pathways. Safe, attractive neighborhood; Reasons for action; 2006. Available at: <http://www.pathwaystooutcomes.org/indexcfm?fuseaction=page+pageid=273>. Accessed October 11, 2006.
48. Center for Public Safety. Neighborhood Walking Guide; 2006. Available at: [http://www.walkinginfo.org/cps/guide\\_issue7.htm](http://www.walkinginfo.org/cps/guide_issue7.htm). Accessed October 11, 2006.
49. Stuff JE, Horton JA, Bogle ML, Connell C, Ryan D, Zaghoul S, Thornton A, Simpson P, Gossett J, Szeto, K. High prevalence of food insecurity and hunger in households in the rural Lower Mississippi Delta. *Journal of Rural Health*. 2004;**20**:173-180.
50. Manley J. *Stata 8*; 2003 ed. College Station, TX: StataCorp LP; 2003.
51. Piachaud D, Webb J. *The Price of Food: Missing Out on Mass Consumption*. London: STICERD: London School of Economics and Political Science; 1996. 1-95.
52. Leather S. Food poverty: the making of modern malnutrition. *Health Visitor*. 1997;**70**:23.
53. Acheson D. *Independent Inquiry Into Inequalities in Health: Report*. London: The Stationery Office; 1998. 1-12.
54. Kantor L. Food Security in the United States: Community Food Security, a report; 2001. Available at: <http://ers.usda.gov/briefing/foodsecurity/community/>. Accessed August 4, 2006.

## VITA

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