

South Dakota State University
**Open PRAIRIE: Open Public Research Access Institutional
Repository and Information Exchange**


Electronic Theses and Dissertations

2018

Food Availability, Including Traditional Foods, in Grocery and Convenience Stores in 6 High Obese Counties in South Dakota, including Native American Reservations

Francesca Willard
South Dakota State University

Follow this and additional works at: <https://openprairie.sdstate.edu/etd>

 Part of the [Human and Clinical Nutrition Commons](#), and the [International and Community Nutrition Commons](#)

Recommended Citation

Willard, Francesca, "Food Availability, Including Traditional Foods, in Grocery and Convenience Stores in 6 High Obese Counties in South Dakota, including Native American Reservations" (2018). *Electronic Theses and Dissertations*. 2435.
<https://openprairie.sdstate.edu/etd/2435>

This Thesis - Open Access is brought to you for free and open access by Open PRAIRIE: Open Public Research Access Institutional Repository and Information Exchange. It has been accepted for inclusion in Electronic Theses and Dissertations by an authorized administrator of Open PRAIRIE: Open Public Research Access Institutional Repository and Information Exchange. For more information, please contact michael.biondo@sdstate.edu.

FOOD AVAILABILITY, INCLUDING TRADITIONAL FOODS, IN GROCERY AND
CONVENIENCE STORES IN 6 HIGH OBESE COUNTIES IN SOUTH DAKOTA,
INCLUDING NATIVE AMERICAN RESERVATIONS

BY

FRANCESCA WILLARD

A thesis submitted in partial fulfillment of the requirements for the

Master of Science

Major in Nutrition and Exercise Sciences

Specialization in Nutritional Sciences

South Dakota State University

2018

FOOD AVAILABILITY, INCLUDING TRADITIONAL FOODS, IN GROCERY AND
CONVENIENCE STORES IN 6 HIGH OBESE COUNTIES IN SOUTH DAKOTA,
INCLUDING NATIVE AMERICAN RESERVATIONS

FRANCESCA WILLARD

This thesis is approved as a creditable and independent investigation by a candidate for the Master of Science in Nutrition and Exercise Science degree and is acceptable for meeting the thesis requirements for this degree. Acceptance of this thesis does not imply that the conclusions reached by the candidate are necessarily the conclusions of the major department.

Lacey McCormack, PhD, MPH, RD, LN, EP-C
Thesis Advisor Date

Kendra Kattelman, PhD, RDN, LN, FAND
Department Head Date

Dean, Graduate School Date

ACKNOWLEDGEMENTS

I would first like to thank my thesis advisor, Dr. Lacey McCormack of the Health and Nutritional Sciences Department at South Dakota State University. She made herself available in all forms whenever I needed help or had a question about my research and writing. She consistently allowed this paper to be my own work, but guided and steered me in the right direction whenever she thought I needed it. I cannot thank her enough for the support and guidance she has given me over the past two years, as this wouldn't have been possible without her.

Additionally, I would also like to thank the rest of my graduate committee: Dr. Jessica Meendering of the Health and Nutritional Sciences Department and Dr. Madhav Nepal of the Biology and Microbiology Department at South Dakota State University. They provided me with insightful comments and guidance on all aspects of my research and writing as well as encouraging words and confidence along the way.

Finally, I would like to thank my family, friends, and boyfriend for the endless love and support they have given me throughout all my years of schooling. I would not have made it this far if it wasn't for all of them encouraging and cheering me on every step of the way. They stuck with me through some of the hardest points of the process and never gave up on me. They gave me inspiration and motivation to use my passions to make an impact everywhere I go and in everything I do. I am forever grateful for their kind words, prayers, and advice as it has shaped me into the person I am today and has given me everything I needed and more to finish this chapter of my life and move onto the next!

TABLE OF CONTENTS

ABSTRACT.....	v
INTRODUCTION.....	1
MATERIALS AND METHODS.....	6
RESULTS.....	8
DISCUSSION.....	9
APPENDIX.....	15
LITERATURE CITED.....	20

ABSTRACT

FOOD AVAILABILITY, INCLUDING TRADITIONAL FOODS, IN GROCERY AND
CONVENIENCE STORES IN 6 HIGH OBESE COUNTIES IN SOUTH DAKOTA,
INCLUDING NATIVE AMERICAN RESERVATIONS

FRANCESCA WILLARD

2018

Native American populations are disproportionately affected by obesity and its associated chronic diseases. Rural areas are also disproportionately affected by obesity and face significant challenges related to their food environment, food security, and food availability. The combination of these barriers make it challenging for rural, NA reservations to combat these health disparities and have opportunities to make healthy food choices. The lack of access to healthy and traditional foods in these areas is of great concern. The purpose of this study is to determine the food availability, including traditional foods, in grocery and convenience stores in six high obese counties in South Dakota, including Native American reservations.

We assessed the rural food environments by utilizing the Nutrition Environment Measures Survey for Stores (NEMS-S) tool to measure the availability of foods, including traditional foods. A selection of one community per county was examined using an observational study of grocery and convenience stores (9 convenience, 6 grocery). We found significant differences in the availability of food for both grocery and convenience stores and also found a limited amount of traditional foods available in these stores. In order to promote and recommend a well-balanced diet, these communities need to have healthy foods that are accessible, affordable, and available for purchase.

INTRODUCTION

The rise of obesity among Native Americans (NA) has been shown to result from an interaction between the environment in which people live coupled with their genetics. Moreover, changes in dietary intake and levels of physical activity can also play a role in the increased prevalence of obesity.¹⁻³ There are a number of characteristics that can be used to explain the health disparities associated with the current obesity epidemic. To focus primarily on changes in dietary intake, data indicates there has been a significant decline in the hunting, gathering, and growing of “traditional” foods and a dramatic increase in the consumption of foods that are higher in unhealthy fats and refined sugars, and lower in healthy fats and fiber.^{4,5} Specific racial and ethnic minority groups are shown to have higher rates of obesity. Lower-income groups and lower socioeconomic status (SES) are also associated with higher rates of obesity, when compared with higher-income groups.^{2,3,6} Given that race/ethnicity, income and SES are associated with higher rates of obesity, NAs are especially impacted. Data suggests that 7% of NAs are obese, compared with 21% of the entire United States (U.S.) population.⁷

To compound this issue, a majority of NA reservations are located in rural areas. Populations living in rural areas are disproportionately affected by obesity, which can potentially lead to further health complications.⁸⁻¹¹ The rural food environment definitely plays a role in the obesity disparity experienced by those who live in rural areas, more specifically, those living in what can be classified as a rural food desert.¹² A food desert can be defined as an area in which all residents have limited access to large food retailers and each individual residing in a food desert is located more than 10 miles away from a supermarket.¹³ There are 66 counties in SD and 31 are classified as a food desert (about

47% of the population). Low-income, minority, or geographically-isolated individuals experience significant challenges in guaranteeing adequate access to grocery stores and supermarkets,¹⁴⁻¹⁷ all of which may be experienced by NA populations living on rural reservations. Grocery stores and chain supermarkets tend to offer various food items and are located, for the most part, in areas populated by Whites and populations with middle or high levels of income (i.e., populations with low levels of food insecurity). However, smaller grocery stores and convenience stores are commonly found in areas populated by racial minority groups and those experiencing high rates of poverty (i.e., populations with high levels of food insecurity).¹⁸

Due to decreased population sizes, rural areas contain a smaller number of supermarkets and a higher number of non-chain grocery and convenience stores, when compared with urban areas.¹⁴ Both the location of food stores and the array of items in those stores play a role in the consumer's ability to make healthy food choices.¹⁸ The current lack of access to food stores presents many challenges for those living in rural areas. However, the lack of overall availability of healthy food options in these rural, food stores may play a bigger role in a consumer's food choices.¹⁹ Observing specific foods that are available, or not, is important in fully understanding the food environment and the negative impacts it can potentially have on people's health. The lack of availability, coupled with not having enough food, can cause rural residents to experience food insecurity. Food insecurity can be either be defined as the state of having limited or uncertain access to food that is nutritionally adequate, safe, and culturally acceptable, or not having the ability to purchase or receive acceptable foods in socially acceptable ways.²⁰ Children suffering from food insecurity are less likely to consume a diet that

follows and meets recommended nutrition guidelines, which can lead to both current and future health complications.^{21,22} Additionally, the recommendation of eating 5 servings of fruits and vegetables per day is not being met by a large number of rural residents.²³ The challenges that rural residents experience may be explained, in part, by factors that influence the quality of foods available for purchase,²⁴ as well as the lack of food that is available in these stores.¹⁷

Physical infrastructure (i.e. buildings, roads, transportation, etc.) is a major barrier to adequate food access in rural areas²⁵ and plays a definitive role in how often rural residents experience food insecurity. Due to substantial changes in the food environment over time, it is not surprising that rural residents experience high rates of food insecurity.¹⁴ The retail food industry is consolidating and rural areas have been affected by increased transportation costs leading to higher food prices, less variety and freshness, and low-quality meat and produce items.¹⁴ Rural residents are forced to travel further distances in order to purchase food as a result of small-town grocery stores closing or areas not having a grocery store at all. This is especially concerning for low-income individuals and families who continually experience threats to food access and food security due to income limitations, not having a vehicle, and lack of public transportation. In many rural areas, a convenience store may be the main and/or only place to buy food items. Consequently, rural individuals and families that only have access to convenience stores experience higher prices and poor food quality and selection.¹⁴ With a combination of poor food access and high poverty rates experienced on rural, NA reservations, food insecurity and its associated health impacts are concerning for NA individuals and families living on or near reservations.²⁶

Racial minority groups, especially NA populations, are disproportionately affected by obesity and have limited access to certain foods.²⁷⁻²⁹ Similar to other populations, this may be directly related to their food environment and food availability. Significant changes have occurred on NA reservations since the middle of the twentieth century, focusing heavily on changes in the availability of and access to healthy foods.^{30,31} Traditionally, NA populations used the land they lived on for hunting, gathering, and growing traditional foods. As a result, NA populations generally consumed a plant-based diet in addition to lean meat and fish sources. Unfortunately, this no longer holds true.³² NA reservations contain a number of fast-food outlets or small grocery and convenience stores. They also provide programs that many NAs rely on such as food-commodity and nutrition assistance programs.^{33,34} These food outlets, stores, and programs tend to have a reduced availability and access of high-quality produce and low-fat foods.³¹ The lack of healthy food availability in these rural areas makes it difficult for individuals and families to not only eat a well-balanced diet, but also decrease their likelihood of experiencing food insecurity. Unfortunately, nearly 40% of families living on a NA reservation in South Dakota are food insecure.²⁶

The most common causes of food insecurity for an individual or family can be described, in part, by economic factors, such as having insufficient income or a limited amount of wealth and resources.²⁶ Psychosocial factors can also play a role in root causes of food insecurity such as mental and physical health, cooking and financial skills, and parental education levels, to name a few. Moreover, lack of food access in rural communities increases the likelihood that an individual or family is experiencing food insecurity. When talking about the environment, it is important to note the vital role of

climatic conditions and its effects on food availability. Agricultural activities that produce the crops sold throughout the marketplace have a huge impact on what food is available as well as the diversity of wildlife and plants used for food on NA reservations. For many indigenous peoples with existing traditions of hunting, gathering, and growing food, having a variety of wildlife and plant species as sources of food is vital in order to achieve and maintain a well-balanced diet.⁴ Taste, price, and convenience all play an important role in consumer food choices. However, food availability and accessibility have a greater influence on consumer food selection.³⁵⁻³⁸ Consumer food selection is undeniably influenced by food that is easily accessible, but more even more so, the accessibility and availability of healthy food options. Food environments focused on the accessibility, affordability, and availability of healthy foods, will in turn, support an increase in the likelihood that an individual or family will consume a well-balanced diet.³⁹

Obesity is linked to the diet which is impacted by food access and availability, which is shaped by the environment in which people live. While obesity and access to healthy foods are an issue, it is especially an issue for NAs who experience high rates of food insecurity and are disproportionately affected by obesity and its associated chronic diseases. Additionally, if well-balanced diets are to include culturally relevant foods, the shift away from traditional foods, and current lack of access to them, is problematic. Therefore, the purpose of this study is to determine the food availability, including traditional foods, in grocery and convenience stores in six high obese counties in South Dakota, including NA reservations.

MATERIALS AND METHODS

Project Background

The purpose of the Centers for Disease Control and Prevention (CDC) 1416 project is to utilize community-based Wellness Coalitions to prevent and reduce obesity in the six SD counties with an obesity prevalence >40%. The CDC 1416 project is part of a bigger research project (CDC's Programs to Reduce Obesity in High Obesity Areas) from the CDC's Division of Nutrition, Physical Activity, and Obesity that began in 2014. The program's purpose is aimed at combating the obesity problem using environmental approaches and help to reduce adverse health outcomes such as diabetes, heart disease, hypertension, and some cancers. The Wellness Coalitions, facilitated by SDSU Extension, conducted a community needs assessment that guided community stakeholders to select and implement appropriate interventions in order to prevent and reduce obesity. The counties involved in this study include Bennett, Buffalo, Campbell, Corson, Union, and Ziebach. The project has focused its efforts within one community per county via neighborhood selection to focus on their overall availability. Table 1 summarizes the demographic information for each county included in the study.

Procedures

As part of the community needs assessment, an observational study of grocery and convenience store environments in the six communities was conducted, using the Nutrition Environment Measures Survey for Stores (NEMS-S) tool. The NEMS-S tool is used to quantitatively assess the availability, price, and quality of food groups such as fruits, vegetables, grains, poultry, and others. It is a widely used instrument with verified

inter-rater and test–retest reliability.^{40,41} For the purpose of this study, we only assessed the availability of foods, not the price or quality. For this community needs assessment, the NEMS-S tool was slightly modified to include traditional foods including antelope, bison, deer, duck, elk, pheasant, tripe, buffalo berries, chokecherries, Morel mushrooms, and prairie turnips. The original tool was sent out to SDSU Extension workers in the study areas of South Dakota, including those with a NA background, and these individuals decided which foods should be added to the modified tool.

Within the target communities, 6 grocery and 9 convenience stores were identified by Extension Specialists/Nutrition Educators and then data were collected by grant personnel over a period of one month in late 2015. All but one county had at least one grocery store, and one county had two grocery stores. All but one county had at least one convenience store, and one county had two convenience stores and another county had four convenience stores.

Stores were scored on availability in each of the 13 food categories (fruit (fresh, frozen, canned), vegetables (fresh, frozen, canned), milk, ground beef, frozen dinners, baked goods, beverages, bread, baked chips, cereal and other grains, tuna, packaged deli meats, and frozen pizza). Stores were also scored on the availability of traditional foods. Availability was defined by whether certain food items were available in the store or not, with a higher value assigned to the food that was available. A score of 1 was assigned for food that was available (yes) and a score of 0 was assigned for food that was not available (no). When a food option was available, additional points were scored and given based on the degree of healthiness, selection, and variety.

Data Analysis

Statistical analysis of the NEMS-S data was conducted to assess the availability of healthy foods in all the communities that were observed. T-tests and chi-squared tests were used to examine differences in availability between grocery and convenience stores. The t-tests were used when examining the number of food items in the stores and then comparing the average number of food items between grocery and convenience stores. The chi-squared tests were used when examining the categories of ‘yes or no’ answer options for food availability, considering if the food was available or not in the specific community and store being observed.

RESULTS

A total of 15 stores (9 convenience, 6 grocery) were examined for their food availability. We found both significant differences and similarities in food availability for both grocery and convenience stores. (Table 2). For traditional foods, tripe was the only food that was available. Tripe was available in 2 grocery stores in 2 different counties. It was not available in any convenience stores. The data also indicated that buffalo was previously available in 2 grocery stores, but it was no longer there. The reason behind the lack of buffalo in stores was due to it being “recently pulled from the shelves” and “it was available at one time but nobody purchased it”. These specific comments were taken during the observational time periods when grant personnel assessed the stores.

Table 2 provides the data collected and analyzed from the observational grocery and convenience store visits. See appendix for additional information regarding the additional NEMS-S score measures on availability of healthier food items. There were

many foods absent in the majority of grocery stores including, but not limited to, lean ground beef, fat-free wieners, single bagels, English muffins, and low-fat muffins, 100% juice drinks, low-fat bologna, and 6-packs of soda. Also, there were many foods absent in the majority of convenience stores including, but not limited to, fresh, frozen, and canned fruits and vegetables, all types of ground beef, frozen dinners, majority of baked goods, bread, low-fat chips, majority of cereals and other grains, some types of deli meats, and healthier frozen pizza options. When examining the foods that were missing from both grocery and convenience stores, the major foods included types of ground beef, reduced fat frozen dinners, and baked goods.

DISCUSSION

The characterization of diet patterns of NA people provides an understanding of the factors that influence their dietary intake. These understandings are necessary in order to promote and support healthy food environments. Research exploring food access and food availability on rural, NA reservations is limited and requires modified tools, like the NEMS-S, to demonstrate the food availability in these specific locations. Further exploration of these food environments can lead to improved access and availability of foods in general, but more specifically, healthy foods. This study determined the food availability, including traditional foods, in grocery stores and convenience stores in 6 high obese counties in SD, specifically NA reservations. Food availability plays a vital role in the development of obesity and other related chronic diseases. This study provides a better understanding of the factors related to NA reservations including an increase in

their availability of unhealthy foods, a decrease in their availability of healthy foods, and an even lower availability of traditional foods.

In the present study, traditional foods were limited in all grocery and convenience stores in the six communities assessed. Only one traditional food (tripe) out of the total eleven traditional foods observed were available. Even more alarming, tripe was only found in 2 grocery stores in 2 different counties, indicating no availability in convenience stores. All traditional foods, except for tripe, were missing in both grocery and convenience stores. Studies have found similar findings to the extent that few traditional foods are consumed in a typical diet, but the majority of these studies are examining dietary intake, rather than the stores people buy their food from.^{5,42,43}

The majority of the current research on “traditional foods” relies heavily on the changes in the content and production of these foods. However, there is limited research on the availability of these traditional foods in areas where people most often purchase foods, specifically grocery and convenience stores. The nutrition and health consequences of changing lifestyles of indigenous peoples in North America have been documented to a greater extent than for indigenous peoples in any other part of the world⁴, however there is a lack of research examining the availability of traditional foods in these areas of North America, specifically SD, NA reservations, which represents 8.9% of the population.⁴⁴

Multiple studies have utilized the NEMS-S tool to further examine the availability of foods in a variety of stores, but a lack of research focusing on traditional foods in these stores is apparent. Moreover, the NEMS-S tool has also focused its efforts in rural areas^{12,39,45-47}, but not in the same way this study examined rural reservation areas in

South Dakota. The limited amount of traditional foods in these areas should be kept in mind when making recommendations to promote healthier food environments. If food security, in general, is an issue, eating traditional foods may not be high on the list of an individual's or family's priorities. Moreover, the definition of food security indicates food should be culturally acceptable, so food security is not achievable if culturally acceptable foods are not available for purchase.

We have tools like the NEMS-S, but some of the tools may not be appropriate in all populations. It is helpful to modify the NEMS-S tool in order to adequately measure food availability in regards to traditional and culturally acceptable foods.

Recommendations can still be made utilizing the current research, but in order to gain a better understanding, further research and modifications on these specific locations, stores, and tools is necessary. We have established and analyzed the specific foods that are available, or are not available in these areas. However, the data does not tell us if consumers are purchasing the foods that are available in these stores.

For the other (non-traditional) foods, the majority of healthier foods were available in grocery stores, but there were some in both as well. The foods found primarily in grocery stores were fresh fruits and vegetables, ground beef, cereals, and rice. The only food that was found in convenience stores that was not found in grocery stores were flavored cereals. Many of the foods were found in both locations. These foods consist of low-fat milk, frozen or canned fruits and vegetables, frozen dinners, baked goods, beverages, bread, baked chips, canned tuna, spaghetti, packaged deli meats, and frozen pizza. Fresh, frozen, and canned fruits and vegetables, ground beef, reduced fat frozen dinners, single bagels, English muffins, low-fat muffins, package of bagels,

oatmeal, brown and white rice, whole wheat spaghetti, canned tuna in oil, and healthier frozen pizza were completely missing from all convenience stores. This was not the case for grocery stores, as at least one food option was represented from the NEMS-S tool for at least one grocery store. In general, the NEMS-S tool provides information on the availability of both unhealthy and healthy food options. The lack of healthy food options was more apparent in convenience stores compared to grocery stores. However, there was still a lack of healthy foods observed in grocery stores as well.

When interpreting the findings of this study, it is important to consider the limitations. The NEMS-S tool was modified by grant personnel, not by those residing in these communities. Gathering insight and feedback from community members actually living and buying food in these specific areas would have been beneficial in modifying the tool, prior to this study, and then examining food availability. There may have been traditional foods we didn't capture with our tool, despite our best attempts to modify it. Another limitation to this study was the lack of areas assessed for food availability. On NA reservations, grocery and convenience stores are not the only place to purchase or receive food. Food assistance programs are another area that this tool could assess because it is a resource that NA populations use to receive a majority of their food. It is very important to analyze all food sources and avenues that individuals may be receiving and getting their food from.

A strength of this study was that this was the first to examine the availability of traditional foods in grocery and convenience stores on NA reservations. The study was also conducted using a validated tool, as well as successfully attempting to capture the information that we assessed by modifying it. Another strength of this study was

successfully examining and portraying the need for interventions in communities that need them and providing valid research as to why interventions need to be done here. Some key risks that provide the need for interventions include NA population's increased risk for chronic diseases as well as having six counties with obesity rates >40%.

Food access and availability is definitely a problem on rural, NA reservations. Primary locations for purchasing food in these communities include grocery and convenience stores. The community nutrition environment is composed of the accessibility, number, type, and location of food outlets that are located within these specific communities. The consequences stemming from changes in the food environment create a number of health disparities and an increased need for interventions addressing the prevention and treatment of obesity. Food is one piece of the puzzle when it comes to addressing health disparities, and the research gives an insight into why.

The implications of food security directly relate to the issue of food access and availability on NA reservations. The availability of food is lower in comparison to other locations in South Dakota and other areas of the U.S. However, the staggering data on the availability of healthy foods is even lower. A number of healthy foods are scarce in convenience stores, and in some cases, these stores are the only stores available for 30 miles or more. The need for healthy foods options, in general, is present in all of these communities. We are pushing all of these recommendations, such as eating more fruits, vegetables, and traditional foods, but we truly do not know if and what people have access to in regards to their food availability.

Processed, convenient, and cheap food products are portrayed as the top priority for food choices on rural, NA reservations in both grocery and convenience stores. There

is a number of healthy food options that aren't available in any of the food stores observed. The majority of healthy foods were only available in grocery stores and a majority of unhealthy foods were found in both. We need to make sure communities have grocery stores with healthy food options and ensure access to them as well. Eventually, these communities need to take it one step further and increase the accessibility of foods such as traditional foods and healthier food options. However, the choice needs to be made by the community and supported by the community. If this is the case, the foods and choices need to be available, acceptable, and affordable in order to promote a healthy food environment for all. Healthy food choices are important in regards to reducing mortality rates, reducing obesity rates, decreasing chronic disease risks and associations, and consuming a variety of healthy foods that promote a well-balanced diet.

APPENDIX

Table 1. County Profiles Included on a Native American Reservation^{48,49}

	Bennett County	Buffalo County	Campbell County	Corson County	Union County	Ziebach County
Reservation	Pine Ridge	Crow Creek	None	Standing Rock	None	Cheyenne River and Standing Rock
Total Population	3,431	1,912	1,466	4,050	14,399	2,801
American Indian	2,109 (61%)	1,607 (84%)	N/A	2,713 (66%)	N/A	2,097 (74%)
White	1,157 (33%)	283 (14%)	1,441 (98%)	1,204 (29%)	13,758 (95%)	610 (21%)
Two or more races	138 (4%)	N/A	N/A	105 (2%)	232 (1%)	N/A
Average Household Size	3	3	2	3	2	3
Urban (SD 51.9)	0	0	0	0	26.6	0
Rural-Farm (SD 7.2)	8.6	7.2	28.9	11.1	9.2	14.1
Rural Non-farm (SD 40.4)	91.4	92.8	71.1	88.9	64.2	85.9
Households	1,114	520	718	1,280	4,948	730
<\$10,000	19.9%	44.8%	16.7%	24.2%	7%	32.6%
\$10,000-14,999	10.8%	9.8%	10.7%	13.6%	5.8%	11.8%
\$15,000-19,999	8.7%	6.2%	7%	10.9%	5.2%	7.7%
\$20,000-24,999	10%	7.5%	9.9%	9.8%	7.6%	9.6%
\$25,000-49,999	32.6%	23.8%	34.1%	27.7%	30.8%	27.8%
\$50,000-149,999	17.8%	7.5%	21.2%	13.1%	38.7%	9.8%
\$200,00 or more	0.2%	0.4%	0.4%	0.4%	3.5%	0.4%
Median Household Income	\$25,755	\$17,787	\$30,882	\$23,126	\$52,431	\$19,877
Education						
B.S. Degree or Higher	12.7%	5.4%	14.8%	11.3%	26.3%	12%
Income						
Below the Official Poverty Line	39.3%	31.6%	11%	32.4%	6.9%	39.4%

Table 2. NEMS-S Measures of Food Availability in Stores

	Convenience Stores (n = 9)	Grocery Stores (n = 6)
	Number of Stores (%) ^a	
Fruit		
Fresh	0-2 ^b	6 (100%)
Frozen and Canned	0	6 (100%)
Vegetables		
Fresh	0	6 (100%)
Frozen and Canned	0-6 ^b	6 (100%)
Milk		
Low-Fat (Skim or 1%)	3 (33%)	6 (100%)
If previous is not available, is 2%?	5 (56%)	N/A
Ground Beef		
Lean Ground Beef (90% lean, 10% fat) or Ground Turkey	0	1 (17%)
Lean Ground Beef (<10% fat)	0	2 (33%)
Standard Ground Beef (80% lean, 20% fat)	0	5 (83%)
Oscar Meyer Weiner, 98% Fat-Free (turkey/beef)	0	0
Fat-Free Weiner, other brand (0g fat)	0	1 (17%)
Frozen Dinners		
Stouffer's Brand	1 (11%)	5 (83%)
Smart Ones (reduced-fat)	0	1 (17%)
Reduced Fat, other brand	1 (11%)	5 (83%)
Baked Goods		
Single Bagels, English Muffins, Low-Fat Muffins	0	0
Package of Bagels	0	5 (83%)
Regular Muffin	5 (56%)	4 (67%)
Regular Danish	1 (11%)	1 (17%)
Beverages		
12 oz. Diet Coke	2 (22%)	N/A ^c
12 oz. Coke	2 (22%)	N/A ^c
20 oz. Diet Coke	8 (89%)	N/A ^c
20 oz. Coke	8 (89%)	N/A ^c
100% Juice (15.2 oz.)	7 (78%)	N/A ^c
Juice Drink (15.2 oz.)	6 (67%)	N/A ^c
12 pack, 12 oz. Diet Coke	N/A ^c	6 (100%)
12 pack, 12 oz. Coke	N/A ^c	6 (100%)

6 pack, 12 oz. Diet Coke	N/A ^c	2 (33%)
6 pack, 12 oz. Coke	N/A ^c	2 (33%)
Minute Maid 100% Juice (half-gallon)	N/A ^c	3 (50%)
Tropicana 100% Juice (half-gallon)	N/A ^c	1 (17%)
Other Juice Drink (half-gallon)	N/A ^c	6 (100%)
Bread		
Sara Lee Classic 100% Whole Wheat	1 (11%)	6 (100%)
Sara Lee Classic White	1 (11%)	5 (83%)
Baked Chips		
Lays Potato and Other Low-Fat	1 (11%)	4 (67%)
Classic Lays Potato	7 (78%)	6 (100%)
Other Regular	6 (67%)	5 (83%)
Cereals and Other Grains		
Plain Cheerios, Other Healthy Cereal (<7g sugar/serving)	1 (11%)	6 (100%)
Flavored Cheerios	4 (44%)	6 (100%)
Quaker Oats Oatmeal	0	6 (100%)
Brown & White Rice	0	6 (100%)
Whole Wheat Spaghetti	0	4 (67%)
Enriched Spaghetti	1 (11%)	6 (100%)
Tuna		
Canned in Water (Chunk)	3 (33%)	6 (100%)
Canned in Oil (Chunk)	0	6 (100%)
Packaged Deli Meats		
Turkey	1 (11%)	6 (100%)
Low-Fat Bologna (chicken and pork)	1 (11%)	2 (33%)
Regular Bologna (chicken and pork)	4 (44%)	6 (100%)
Frozen Pizza		
Healthier (<300 kcal, <10g fat)	0	3 (50%)
Regular	5 (56%)	6 (100%)

a Column numbers indicate the number of stores the associated food was available in; Percentages calculated on the basis of total stores examined

b Ranges indicate number of stores where associated fruits and vegetables were available; There were a variety of fruits and vegetables assessed, but each fruit or vegetable is not individually listed in each row

c Certain beverages (quantity, brand/name, etc.) were only assessed in convenience stores and other beverages were only assessed in grocery store

Additional NEMS-S Score Measures on Availability of Healthier Food ItemsItem = Milk

- YES low-fat/skim = 2 points
- YES low-fat milk alternatives = 1 point

Item = Fresh Fruit

- 0 varieties = 0 points
- <5 varieties = 1 point
- 5-9 varieties = 2 points
- 10 varieties = 3 points

Item = Frozen/Canned Fruit

- 0 varieties = 0 points
- <5 varieties = 1 point
- 5-9 varieties = 2 points
- 10 varieties = 3 points

Item = Fresh Vegetables

- 0 varieties = 0 points
- <5 varieties = 1 point
- 5-9 varieties = 2 point
- 10 varieties = 3 points

Item = Frozen/Canned Vegetables

- 0 varieties = 0 points
- <5 varieties = 1 point
- 5-9 varieties = 2 points
- 10 varieties = 3 points

Item = Ground Beef

- YES lean meat = 2 points
- 2-3 varieties \leq 10% fat = 1 point
- >3 varieties \leq 10 % fat = 2 points

Item = Hot Dogs

- YES fat-free = 2 points
- Light, not fat-free = 1 point

Item = Frozen Dinners

- YES all 3 reduced-fat types = 3 points
- YES 1 or 2 reduced-fat types = 2 points

Item = Baked Goods

- YES low-fat items = 2 points

Item = Beverages

- YES diet soda = 1 point
- YES 100% juice = 1 point

Item = Bread

- YES whole grain bread = 2 points
- >2 varieties whole wheat bread = 1 point

Item = Baked Chips

- YES baked chips = 2 points
- >2 varieties baked chips = 1 point

Item = Cereal and Other Grains

- YES healthier cereal = 2 points
- YES healthier oatmeal = 1 point
- YES healthier rice = 1 point
- YES healthier spaghetti = 1 point

Item = Tuna

- YES tuna in water = 1 point

Item = Packaged Deli Meats

- YES packaged turkey = 1 point
- YES low-fat bologna = 1 point

Item = Frozen Pizza

- YES healthier frozen pizza = 1 point

Item = Traditional Foods

- YES traditional foods = 2 points
- 2-4 varieties = 1 point
- 5-7 varieties = 2 points
- > 7 varieties = 3 points

LITERATURE CITED

1. Young TK, Reading J, Elias B, O'Neil JD. Type 2 diabetes mellitus in Canada's first nations: status of an epidemic in progress. *CMAJ*. 2000;163(5):561-566.
2. Drewnowski A, Specter SE. Poverty and obesity: the role of energy density and energy costs. *Am J Clin Nutr*. 2004;79(1):6-16.
3. Baltrus PT, Lynch JW, Everson-Rose S, Raghunathan TE, Kaplan GA. Race/ethnicity, life-course socioeconomic position, and body weight trajectories over 34 years: the Alameda County Study. *Am J Public Health*. 2005;95(9):1595-1601.
4. Kuhnlein HV, Receveur O. Dietary change and traditional food systems of indigenous peoples. *Annu Rev Nutr*. 1996;16:417-442.
5. Whiting SJ, Mackenzie ML. Assessing the changing diet of indigenous peoples. *Nutr Rev*. 1998;56(8):248-250.
6. Sobal J, Stunkard AJ. Socioeconomic status and obesity: a review of the literature. *Psychol Bull*. 1989;105(2):260-275.
7. Liao Y, Tucker P, Okoro CA, et al. REACH 2010 Surveillance for Health Status in Minority Communities --- United States, 2001--2002. *MMWR Surveill Summ*. 2004;53(6):1-36.
8. Lutfiyya MN, Lipsky MS, Wisdom-Behounek J, Inpanbutr-Martinkus M. Is rural residency a risk factor for overweight and obesity for U.S. children? *Obesity (Silver Spring)*. 2007;15(9):2348-2356.

9. Befort CA, Nazir N, Perri MG. Prevalence of obesity among adults from rural and urban areas of the United States: findings from NHANES (2005-2008). *J Rural Health*. 2012;28(4):392-397.
10. O'Connor A, Wellenius G. Rural-urban disparities in the prevalence of diabetes and coronary heart disease. *Public Health*. 2012;126(10):813-820.
11. Larson NI, Story MT, Nelson MC. Neighborhood environments: disparities in access to healthy foods in the U.S. *Am J Prev Med*. 2009;36(1):74-81.
12. Pitts SB, Bringolf KR, Lawton KK, et al. Formative evaluation for a healthy corner store initiative in Pitt County, North Carolina: assessing the rural food environment, part 1. *Prev Chronic Dis*. 2013;10:E121.
13. Morton LC, Blanchard TC. Starved for Access: Life in Rural America's Food Deserts. *Rural Sociological Society*. 2007;1(4):10.
14. Sharkey JR, Horel S. Neighborhood socioeconomic deprivation and minority composition are associated with better potential spatial access to the ground-truthed food environment in a large rural area. *J Nutr*. 2008;138(3):620-627.
15. Zenk SN, Schulz AJ, Israel BA, James SA, Bao S, Wilson ML. Neighborhood racial composition, neighborhood poverty, and the spatial accessibility of supermarkets in metropolitan Detroit. *Am J Public Health*. 2005;95(4):660-667.
16. Liese AD, Weis KE, Pluto D, Smith E, Lawson A. Food store types, availability, and cost of foods in a rural environment. *J Am Diet Assoc*. 2007;107(11):1916-1923.

17. Powell LM, Slater S, Mirtcheva D, Bao Y, Chaloupka FJ. Food store availability and neighborhood characteristics in the United States. *Prev Med.* 2007;44(3):189-195.
18. Baker EA, Schootman M, Barnidge E, Kelly C. The role of race and poverty in access to foods that enable individuals to adhere to dietary guidelines. *Prev Chronic Dis.* 2006;3(3):A76.
19. Bustillos B, Sharkey JR, Anding J, McIntosh A. Availability of more healthful food alternatives in traditional, convenience, and nontraditional types of food stores in two rural Texas counties. *J Am Diet Assoc.* 2009;109(5):883-889.
20. Core Indicators of Nutritional State for Difficult-to-Sample Populations. *The Journal of Nutrition.* 1990;120(suppl_11):1555-1600.
21. Kaiser LL, Melgar-Quinonez HR, Lamp CL, Johns MC, Sutherlin JM, Harwood JO. Food security and nutritional outcomes of preschool-age Mexican-American children. *J Am Diet Assoc.* 2002;102(7):924-929.
22. Widome R, Neumark-Sztainer D, Hannan PJ, Haines J, Story M. Eating when there is not enough to eat: eating behaviors and perceptions of food among food-insecure youths. *Am J Public Health.* 2009;99(5):822-828.
23. Lutfiyya MN, Chang LF, Lipsky MS. A cross-sectional study of US rural adults' consumption of fruits and vegetables: do they consume at least five servings daily? *BMC Public Health.* 2012;12:280.
24. Walker RE, Keane CR, Burke JG. Disparities and access to healthy food in the United States: A review of food deserts literature. *Health Place.* 2010;16(5):876-884.

25. Smith C, Morton LW. Rural food deserts: low-income perspectives on food access in Minnesota and Iowa. *J Nutr Educ Behav.* 2009;41(3):176-187.
26. Bauer KW, Widome R, Himes JH, et al. High food insecurity and its correlates among families living on a rural American Indian Reservation. *Am J Public Health.* 2012;102(7):1346-1352.
27. O'Connell J, Yi R, Wilson C, Manson SM, Acton KJ. Racial disparities in health status: a comparison of the morbidity among American Indian and U.S. adults with diabetes. *Diabetes Care.* 2010;33(7):1463-1470.
28. Slattery ML, Ferucci ED, Murtaugh MA, et al. Associations among body mass index, waist circumference, and health indicators in American Indian and Alaska Native adults. *Am J Health Promot.* 2010;24(4):246-254.
29. Acton KJ, Burrows NR, Moore K, Querec L, Geiss LS, Engelgau MM. Trends in diabetes prevalence among American Indian and Alaska native children, adolescents, and young adults. *Am J Public Health.* 2002;92(9):1485-1490.
30. Story M, Strauss KF, Zephier E, Broussard BA. Nutritional concerns in American Indian and Alaska Native children: transitions and future directions. *J Am Diet Assoc.* 1998;98(2):170-176.
31. Styne DM. Childhood obesity in American Indians. *J Public Health Manag Pract.* 2010;16(5):381-387.
32. Companion M. An Overview of the State of Native American Health: Challenges and Opportunities. 2008;
https://www.researchgate.net/publication/266219103_An_Overview_of_the_State

- [of Native American Health Challenges and Opportunities](#). Accessed February 23, 2017.
33. Dillinger TL, Jett SC, Macri MJ, Grivetti LE. Feast or famine? Supplemental food programs and their impacts on two American Indian communities in California. *Int J Food Sci Nutr*. 1999;50(3):173-187.
 34. Finegold K, Pindus NM, Wherry L, Nelson S, Triplett T, Capps R. Background Report on the Use and Impact of Food Assistance Programs on Indian Reservations. 2005; <http://www.urban.org/research/publication/background-report-use-and-impact-food-assistance-programs-indian-reservations>. Accessed February 24, 2017.
 35. Steptoe A, Pollard TM, Wardle J. Development of a measure of the motives underlying the selection of food: the food choice questionnaire. *Appetite*. 1995;25(3):267-284.
 36. Cummins S, Macintyre S. "Food deserts"--evidence and assumption in health policy making. *BMJ*. 2002;325(7361):436-438.
 37. Delva J, O'Malley PM, Johnston LD. Availability of more-healthy and less-healthy food choices in American schools: a national study of grade, racial/ethnic, and socioeconomic differences. *Am J Prev Med*. 2007;33(4 Suppl):S226-239.
 38. Glanz K, Basil M, Maibach E, Goldberg J, Snyder D. Why Americans eat what they do: taste, nutrition, cost, convenience, and weight control concerns as influences on food consumption. *J Am Diet Assoc*. 1998;98(10):1118-1126.

39. Story M, Kaphingst KM, Robinson-O'Brien R, Glanz K. Creating healthy food and eating environments: policy and environmental approaches. *Annu Rev Public Health*. 2008;29:253-272.
40. Glanz K, Sallis JF, Saelens BE, Frank LD. Nutrition Environment Measures Survey in stores (NEMS-S): development and evaluation. *Am J Prev Med*. 2007;32(4):282-289.
41. Glanz K. NUTRITION ENVIRONMENT MEASURES SURVEY (NEMS-S). 2013; <http://www.med.upenn.edu/nems/> Accessed January 22, 2017.
42. Bruner BG, Chad KE. Dietary practices and influences on diet intake among women in a Woodland Cree community. *J Hum Nutr Diet*. 2014;27 Suppl 2:220-229.
43. Gittelsohn J, Wolever TM, Harris SB, Harris-Giraldo R, Hanley AJ, Zinman B. Specific patterns of food consumption and preparation are associated with diabetes and obesity in a Native Canadian community. *J Nutr*. 1998;128(3):541-547.
44. United States Census 2010. *2010 Census Interactive Population Search* 2010; <http://www.census.gov/2010census/popmap/ipmtext.php?fl=46>, 2010.
45. Partington SN, Menzies TJ, Colburn TA, Saelens BE, Glanz K. Reduced-Item Food Audits Based on the Nutrition Environment Measures Surveys. *Am J Prev Med*. 2015;49(4):e23-33.
46. Pereira RF, Sidebottom AC, Boucher JL, Lindberg R, Werner R. Assessing the food environment of a rural community: baseline findings from the heart of New Ulm project, Minnesota, 2010-2011. *Prev Chronic Dis*. 2014;11:E36.

47. Byker Shanks C, Ahmed S, Smith T, et al. Availability, Price, and Quality of Fruits and Vegetables in 12 Rural Montana Counties, 2014. *Prev Chronic Dis.* 2015;12:E128.
48. Network BHK. SD's Indian Reservation Counties Show Modest Growth or Declines in Population. 2015; <http://www.southdakotadashboard.org/sd-s-indian-reservation-counties-show-modest-growth-or-declines-in-population> Accessed January 22, 2017.
49. Brooks T, McCurry M, Hess D. South Dakota State and County Demographic Profiles. 2008.